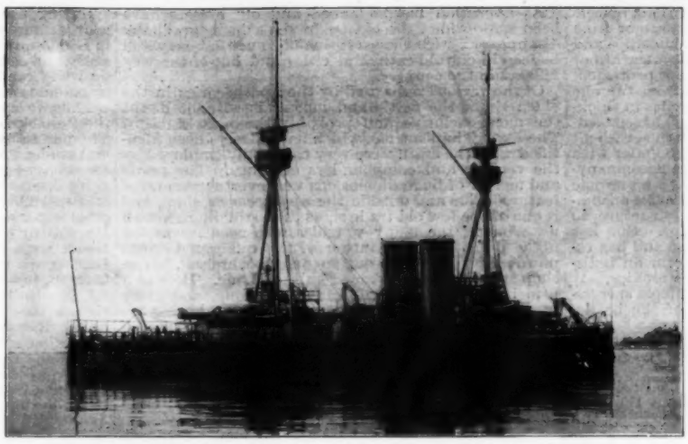
SCIENTIFIC AMERICAN SUPPLEMENT. No. 1205

Copyright, 1899, by Munn & Co.

Scientific American, established 1845.
Scientific American Supplement, Vol. XLVII, No. 1205. NEW YORK, FEBRUARY 4, 1899. Scientific American Supplement, $5 a year.
Scientific American and Supplement, $7 a year.

A REPRESENTATIVE BATTLESHIP AND COAST DEFENSE VESSEL OF THE FRENCH NAVY.

WE present in the accompanying illustrations representative ships of two of the most important types in the French navy—the first-class sea-going battleship "Jauréguiberry" and the coast defense vessel "Caiman." In the issue of the SCIENTIFIC AMERICAN of December 31, 1898, we published a comparison of the strength of the leading navies of the world, from which it will be seen that France's navy contains fourteen first-class battleships, as against thirty-four in the British navy, seventeen in the Russian navy, and thirteen in our own, this estimate including ships under ten years of age, now either building or completed. In coast defense vessels France is relatively stronger, possessing fourteen, as against twenty-five for Great Britain, fourteen for Russia, and eleven for the United States. In reference to battleships, it is but fair to state that France makes a strong showing in battleships from ten to twenty years old and in battleships of over twenty years, possessing nine in the former class, as against eleven for Great Britain, five for Russia, and none for the United States; while in old battleships, many of which have been or are now being refitted, she possesses twelve, as against nine for Great Britain, one for Russia, and none for the United States. The totals of battleships of all three classes are thirty-five ships of 341,451 tons total displacement for France, as against fifty-four battleships of 660,334 tons for Great Britain, twenty-three battleships of 250,891 tons for Russia, and fourteen battleships of 143,130 tons displacement for the United States.



FRENCH COAST DEFENSE VESSEL "CAIMAN."

Displacement, 7,200 tons. Speed, 14½ knots.

The history of French battleship building is extremely interesting, because of the many failures and the still more numerous successes which the French designers have made in their attempts to produce an ideal fighting ship. There is no nation, not even excepting our own, whose naval architects have been so daring and original in their methods. They may be said to have tried, at one time or another, all the various types of battleships and methods of mounting guns and disposing them in the ship which are to be found in the other navies of the world, and in many of these particulars they were original and set an example which other nations have not been slow to follow. Among other modern and accepted practices which are due to the French initiative may be mentioned the mounting of heavy guns "en barbette," the use of electricity for hoisting ammunition and for working the turrets and guns, and the use of water-tube boilers and triple screws; while to these may fairly be added smokeless powder, with its accompaniment of guns of extreme length and high velocity, and the use of high explosive shells.

The "Jauréguiberry" is a twin screw battleship of 11,824 tons displacement and a maximum speed of 18·07 knots. She was built from the design of M. Lagane at the Forges et Chantiers de la Mediterranée, the contract speed being 17·5 knots. She is armed as follows: The main armament consists of two 12-inch and two 10·6-inch guns mounted in turrets at the four angles of a quadrilateral; one 12-inch being forward of the bridge, another aft on the quarter deck, and two

From photograph by Symonds & Co., Portsmouth, England.

FIRST-CLASS BATTLESHIP "JAURÉGUIBERRY," OF THE FRENCH NAVY, ON HER TRIAL TRIP.

Displacement, 11,824 tons. Speed, 18·07 knots.

amidships, one on either beam. The turret armor protecting these guns is 14½ inches thick. The intermediate battery consists of eight 5·5-inch rapid-fire guns in turrets of 4-inch armor, disposed as follows: Four forward, two on each beam, with an arc of fire extending from well abaft beam to dead ahead, and four aft, two on each beam, with an arc of fire extending from well forward to dead astern. The guns are placed in pairs, two in a turret, there being thus four turrets in all. It will thus be seen that the guns secure excellent protection for a comparatively small amount of weight. The secondary battery consists of four 2½-inch, twelve 1·8-inch rapid-fire guns, and eight 1·4-inch machine guns. There are six torpedo tubes, two of which are merged below the waterline. Both the guns and the turrets are so arranged that they can be worked either by hand or by electricity. The "Jauréguiberry" being thus the first big battleship to be fitted throughout with a double system of motive power of this kind.

The dimensions of the ship are as follows: length, 364 feet; beam, 72 feet 10 inches; maximum draught, 27 feet 9 inches; and maximum indicated horse power, 15,900. She is capable of carrying a normal coal supply of 700 tons, and her full complement is 625 officers and men. She has a continuous belt of armor from stem to stern which is 17¾ inches thick amidships and tapers toward the ends. The space between the armor belt and the bottom of the barbette is not protected, but an armored ammunition trunk leads from the one to the other. The protected deck is 2¾ inches in thickness. It is said that the "Jauréguiberry" has exceedingly handsome lines, and on account of the excellent arrangement of her interior she is very popular with her officers. It is unquestionable, as our accompanying engraving will show, that the ship has a handsome and imposing appearance. Her decks are not encumbered with the towering mass of superstructure so characteristic of most French battleships. She has been a successful ship from the very first and has escaped the alterations which seem to form an indispensable part of the early life of French warships.

Our engraving is made from one of the most successful photographs that was ever secured of the battleship under full speed. It was taken at a time when the ship was traveling at a speed of 18 knots or over twenty miles an hour, and the wave line, it will be seen, is particularly well defined.

In the "Caiman" we have one of four identical coast defense vessels which were launched about the year 1885; the others are the "Suffren," "Terrible," and "Requin." They vary somewhat in armament, but are similar in speed and protection. The "Caiman" is built of iron and steel, and has the following dimensions: length, 278 feet 3 inches; beam, 59 feet; maximum draught, 24 feet 7 inches; indicated horse power, 6,000; speed, 14½ knots; displacement, 7,639 tons; coal supply, 400 tons; and complement, 332 officers and men. She is protected by a belt of armor extending continuously from stem to stern, the maximum thickness of which is 19½ inches. The main battery consists of two 16½-inch 75-ton guns and is carried in two barbettes, one forward and one aft, the barbettes being 17¾ inches in thickness. These guns are supplemented by a battery amidships of four 3·9-inch rapid-fire guns. There are also on the bridge, in the tops and in various commanding positions throughout the ship eighteen small rapid-fire guns and machine guns. The 75-ton guns are old weapons of 1875 pattern; their total length is 32½ feet, and the length of the bore is 22 calibers. The armor-piercing projectile weighs 1,720 pounds and the common shell 1,433 pounds. With 604 pounds of powder the gun can throw the armor-piercing projectile with a velocity of 1,663 feet per second and a muzzle energy of 17,750 foot tons; the penetration at the muzzle being 21·3 inches. The "Caiman" and the other vessels of her class are now being refitted and rearmed. The 75-ton gun will give place to the new 13·4-inch rifle, which is the most powerful weapon afloat in any navy to-day. It has a length of 35 calibers and weighs 53 tons; it throws an armor-piercing projectile weighing 926 pounds with a muzzle velocity of 2,625 feet per second and a muzzle energy of 44,230 tons, the perforation at the muzzle being 42·5 inches. It is evident that when the rearming has been completed these vessels, together with four ships of the "Valmy" type, which are also armed with a couple of the latest high-power heavy rifles, will form an exceedingly formidable coast defense flotilla, which on account of its sea-going qualities, and the satisfactory amount of coal carried, will be available for operations either in the Channel, on the Atlantic, or on the Mediterranean coast. It is to be regretted that the new coast defense vessels (monitors) authorized for our navy are not of the speed, size, and sea-going quality of the French vessels of the coast defense type.

APOTHECARIES' SIGNS IN THE OLDEN TIME.

By C. J. S. THOMPSON.

To those who delight to explore the bypaths of history and love to linger over the relics of the past, the origin of signs and signboards is a subject of more than passing interest. The origin and rationale of trade signs is by no means obscure, as it can be readily conceived that at a period when few people could read or write some method of indicating the abode and nature of a man's calling or craft became indispensable. In ancient times there was no system of numbering houses, and even the names of thoroughfares were only known by word of mouth; so the adoption of some kind of sign became a matter of necessity. Many of our streets took their names from the signs of the old inns, which were generally the first buildings to be erected in new thoroughfares. Signboards were known and used by the ancient Greeks and Romans. To the latter we owe the origin of the bush as a tavern sign, which is used in some parts of Europe for the same purpose to-day. Among the ruins of Herculaneum and Pompeii both printed and carved signs have been discovered. These generally take the forms of the tools used by the various artificers, and so used to indicate their craft. Thus have been found a goat, the sign of a dairy; for a baker, a millstone and ears of corn; and for the physician, a cupping glass, etc. The Romans also carved similar signs on their tombs.

From this custom the trade signs that became general in the middle ages were doubtless derived. For this purpose some object or tool typical of the trade or craft was usually chosen, and an enlarged model or picture hung over the doorway of the shop or dwelling. Great care was generally bestowed upon the ornamentation of the ironwork by which it was suspended, and many beautiful examples may still be seen of this class of ironwork. Of these simple signs we have the stocking for the hosier, the fish for the fishmonger, a pair of scissors for the tailor, a bunch of grapes for the vintner, and the pestle and mortar for the apothecary. But as time went on and competition became greater, something more was required, and each trader wanted a special sign to distinguish him from his fellows, and so all kinds and varieties of symbols, mythological and astrological, were adopted, and the animal and vegetable kingdoms were ransacked to supply the subjects for signboards.

In 1695 the signs in the London streets became so numerous it was proposed by some ingenious individual to the House of Commons that a tax should be placed upon them, whereby it was stated half a million per annum might be easily raised. This proposal, however, was not carried out.

As education has advanced and our streets have been made wider, the old trade signs have gradually disappeared, with the exception of some that may still be seen in our old cathedral cities and out-of-the-way villages in the country.

Of the various signs used by the apothecaries in the olden times, the pestle and mortar is without doubt the most exclusive and probably the most ancient. These early implements, which have always been identified with the craft, were very commonly employed by the venders and compounders of drugs. The pestle and mortar of huge dimensions was ever a prominent feature inside and outside the apothecary's shop, and is one of the few old trade signs that still lingers with us. Among the many worthies who used it was the noted John Moore, "author of the celebrated worm powder," as he was wont to describe himself, whose shop stood in St. Lawrence Poultney Lane. He was a firm believer in the value of advertising, and every week the papers of his time contained a glowing account of the wonderful cures resulting from the use of his powders. It was to this old apothecary Pope addressed the following lines:

> How much, egregious Moore, are we
> Deceived by shows and forms;
> Whate'er we think, whate'er we see,
> All human kind are worms.

The pestle and mortar were also frequently used as a sign by the early French apothecaries, and we have record of the "Golden Mortar," the "Silver Mortar," and the "Golden Pestle," being employed to indicate certain ancient Parisian pharmacies. The latter historic house, situate in the Rue des Lombards, is said to have been founded in 1423, and is mentioned by Dumas in his romance of the "Three Musketeers."

The sign of the "Pestle" adorned a famous inn in Paris much frequented by gallants in the sixteenth century. It is said the proprietor adopted this distinctive pharmaceutical sign on account of his living in the Rue de la Mortellerie (Mortar Street).

Another sign much favored by the early apothecaries was the "Phœnix," which, like the dragon and the salamander, was used to symbolize certain transformations in alchemy and the indestructibility of various bodies. This mythical bird has been used as a sign by Messrs. Godfrey & Cooke since the foundation of their historic house in 1680. The dragon was another popular sign in the middle ages. The early alchemists generally employed it as the emblem of mercury, and the effigy of this monster was not only suspended over the doors of the apothecaries' shops, but was also frequently painted on the gallipots and otherwise used in the form of decoration. The crocodile, which often hung from the ceiling of the dark laboratory, doubtless served to typify this mysterious animal, and inspire awe in those who came to consult the wise apothecary. The marvelous properties once attributed to the horn of the unicorn were the cause of this mysterious animal being frequently employed as a sign by the apothecaries. The horn was considered an invaluable alexipharmic or antidote to all poisons, and, owing to the difficulty in obtaining it, commanded enormous prices. Its popularity as a sign with the apothecaries doubtless led to the animal being adopted as a supporter for the arms of the Society of Apothecaries when that body was founded.

Much interesting lore might be written concerning the unicorn and the quaint traditions connected with it. The land of its birth was always a matter of speculation to the old philosophers. The hunters were said to have great difficulty in getting to close quarters and capturing it, owing to its extreme shyness, until its susceptibility to feminine charms was at length discovered, which led to the following method of capture being devised: A young and handsome virgin was taken to the places where it resorted, and then left to recline on a grassy bank.

Directly the unicorn perceived her, he would come and lie quietly down beside her, resting his head in her lap, and fall asleep, in which state he might be surprised by the hunters who lay in ambush close by. Albertus Magnus, in his work entitled "De Animalibus," states: "It is reported that the unicorn's horn sweats when it comes in the presence of poison, and that for this reason it is laid on the tables of the great and made into knife handles, which, when placed on the tables, show the presence of poison." This supposed property, at a period when secret poisoning was a very common method of revenge or removing an enemy, caused the unicorn's horn to be assessed at an enormous value. The usual price charged by the apothecaries in the sixteenth century was £24 per ounce, or about twelve times the current value of gold. Unicorns' horns were accounted among the most valued possessions of many European monarchs. The chief source of these horns was the narwhal or sea unicorn.

It is a curious fact that the rhinoceros, which was also used as an apothecary's sign, and still forms a part of the arms of the Apothecaries' Society, was regarded as the unicorn by the ancient Egyptians and Hindoos. The same superstitious ideas were connected with its horn, which was used as a remedial agent and an antidote to poisons. Shavings of the horn were said to cure convulsions in children, and drinking cups made from it were supposed to reveal any poisonous draught that might be poured into them by making the liquor ferment on standing.

Another sign which was somewhat a favorite with the craft was that of "Bel and the Dragon," supposed to have been derived from the apocryphal book of that name, although the heathen god is generally represented on the sign in the form of a bell. It was adopted as the original sign by the house of Corbyn & Company, which firm still preserves a curious stone bass relief in a room in their warehouse in High Holborn representing a dragon and a bell.

The burly figure of Paracelsus, whose renown spread throughout Europe in the middle ages, frequently adorned the signs of the apothecaries of the seventeenth century. The "Butler's Head," another common sign, was derived from one Dr. Butler, a physician to James I. According to Fuller, he was "the Æsculapius of that age," and invented a kind of medicated ale, which was sold at the shops bearing the sign of the inventor's head. Butler died in 1617, and, according to Hotten, one of the last of the shops to bear his name stood in a court leading from Basinghall into Coleman Street.

During the early part of the seventeenth century a large number of quack doctors and empirics flourished in London, most of whom combined the callings of physician and astrologer. Among them the "Lilly's Head," derived from the famous astrologer of that name, was a common sign.

Thus we learn from the Bagford Bills (Bib. Harl. 5964) the "Black Bull and Lilly Head" was the sign of one Thomas Saffold, "an approved and licensed physician and student in astrology; he hath practiced astronomy for twenty-four years, and hath had the Bishop of London's license to practice physick ever since the 4th day of September, 1674, and hath, he thanks God for it, great experience and wonderful success in those arts." He was to be found at the "'Black Bull and Lilly Head,' next door to the feather shops that are within Blackfriars gateway, which is over against Ludgate Church, just by Ludgate, in London."

"The Bulls," of one color or another, were a frequent sign with empirics. Another sign, originated by a quack doctor, was that of the "Anodyne Necklace." This wonderful appliance was as well known to Londoners in the early part of the last century as certain famous pills are to-day. The proprietors advertised it extensively in every existing medium in such terms as the following, which is taken from The Weekly Journal, January 4, 1718: "The Anodyne Necklace for children's teeth, woman in labour, and distempers of the head; price 5/-. Recommended by Dr. Chamberlain. Sold up one pair of stairs at the sign of the 'Anodyne Necklace,' without Temple Bar; at the 'Spanish Lady,' at the Royal Exchange, next Threadneedle Street; at the 'Indian Handkerchief,' facing the new stairs in Wapping," etc.

The "Hand and Face" was the sign adopted by another quack doctor who lived in Water Lane, Blackfriars, near the Apothecaries' Hall, in 1735. The "Hand" pointing to some special organ, such as the eye or the ear, was often employed as a sign by these early practitioners; thus intimating to the passersby that the great doctor who lived within cured the blind or the deaf. The "Hand and Ear" was the sign of S. Ketelby, sworn physician, who practiced in Exeter Street, Strand, and, according to his handbill in the Harleian collection,

"He is capable now, not only of curing those incurable by others, but even those he could not cure himself six months ago! Note: He resolves all persons deaf from external causes, whether curable or not, in two minutes, in the dark as well as at noonday, which no other pretender can do," etc. A wonderful physician indeed!

The "Fountain" was the appropriate sign of one Mr. Drinkwater, who kept a shop in the Strand, where according to his advertisement in The Intelligencer, of September 4, 1665: "Monsieur Augier's famous Remedies" were sold, "for stopping and preventing the plague, having not only been recommended by several certificates from Lyons, Paris, Thoulouse, etc., but likewise experimented here by the special directions of the Lords of His Majesty's most honorable Privy Council, and proved by witnesses upon oath, and several Tryals, to be of singular virtue and effect are to be had at Mr. Drinkwater's, at the 'Fountain,' in Fleet Street," etc.

Hotten also states the "Two Twins" or "Naked Boys," was the sign of an empiric in Moorfields, near the steps going out of the lower field into the middle field. "There is a door above the steps and another below the steps, with the 'Twins' and the name Langham on both doors." "Keep the bill to prevent mistaking the house or being sent to a wrong place." So ran the quaint handbill of Master Langham.

The "Golden Beard" is the curious sign of an historic pharmacy in Paris, which dates from 1663. Here Master Pomet is said to have written his celebrated "History of Drugs," a curious connecting link between pharmacy past and present.

This sign is said to have originated from the following incident: "After the battle of Nancy, wherein Charles the Bold, Duke of Burgundy, was killed by the Duke of Lorraine, the latter went in procession to visit the body, clothed in deep mourning with a golden beard fixed on, that reached down to his waist (after the manner of the old heroes that were knighted for their prowess, who, on a signal victory over an enemy, were honored with such a beard)."

Much more might be wrrtten concerning the quaint signs used by the old apothecaries. Of the "Golden Helmet," in Fenchurch Street, where once was sold a strange nostrum, yclept "The Philosopher's Egg," of the "Three Black Lyons" in the Old Bailey, kept by Master Smith, who had the only true receipt for making the celebrated "Vatican Pills;" but these we must leave for another time.—Pharmaceutical Journal.

Low Birth Rate in France.—The Journal Officiel publishes the following statistics of deaths and births in France during 1897: The number of births was 859,107, being 6,479 less than during the previous year. While in Germany, Austria-Hungary, and Italy there are 38 births to every 1,000 inhabitants, the number of babies born in France is but 24, while in 1897 it was only 22. The number of births exceeded the deaths by 108,088, merely because the said year showed an exceedingly small mortality.

HERMANN WILHELM VOGEL.

PROF. HERMANN WILHELM VOGEL, the well known photo-chemist and spectro-analyst, died on December 17 at his villa in the Grunewald Colony, near Berlin. To him is due the honor of the scientific development of photography, the progress in photo-chemical processes and in the technology of photography, the introduction of photography in colors, the application of photography to printing; in fact, of important advances in all branches of the art. The services he rendered to photo-chemistry constitute the most prominent features of the picture of his life work, but upon closer examination other fine lines strike us. Hand in hand with his photo-chemical researches go studies in astronomy and astro-physics, in esthetics and in practical psychology, and finally, we must not forget Vogel's delightful books of travel.

Vogel was a self-made man. His education was most unusual. He was born in 1834 at Dobrilugk, in Prussia, and when fourteen years of age he left school to enter a business house as an apprentice, but when nineteen years old he changed his vocation. An ardent interest in the natural sciences determined him to enter the Gewerbeakademie (academy of technology), in Berlin, where he devoted himself chiefly to the study of physics and chemistry. His principal teachers were the chemist Karl Rammalsberg, the physicist Dove, and the technologist Rudolf Weber. After the completion of his academic studies, Vogel was occupied for a short time as chemist in a sugar factory, but afterward returned to the Gewerbeakademie, and in 1858 was given a position there as assistant in the chemical laboratory. In 1860 Gustav Rose called him to the Mineralogical Museum of the University. Vogel's apprenticeship lasted until 1864, and then he attained an independent position. He had recognized that the development of photography depended on the careful study of photo-chemistry, and he made this study his special task. At the same time he began to give instruction in photography, being the first to teach it in a German technical academy. In 1864 he was made an instructor of photography in the Gewerbeakademie; he began with courses in photography, but added to this practice in the blue print process. Later he lectured on and experimented in spectrum analysis. Gradually Vogel accomplished what he had planned for himself at the beginning of his academic course, for

THE LATE HERMANN WILHELM VOGEL.

photo-chemistry became a regular branch of study in polytechnic courses, and when the Gewerbeakademie was moved to the buildings of the Technical High School, at Charlottenburg, in 1884, a laboratory for the study of photo-chemistry and spectrum analysis on a large scale was arranged for Vogel, and a large sum of money for the purchase of apparatus was placed at his disposal. At the head of a staff of scientific and technical assistants, he developed great ability as an instructor and an investigator, but his work along these lines was repeatedly interrupted by scientific expeditions, during some of which he did good work in astronomy. In 1868 Vogel went to Aden with the Solar Eclipse Expedition; in 1870 and 1875 he went with similar English expeditions to Sicily and the Nicobar Islands, and in 1887 to Russia to observe the solar eclipse which occurred on August 19. He also attended many international expositions, where he gained many friends for German science and technique in photography. At the request of professional colleagues in America, he made two extended tours in the United States. We see that Vogel was seldom quiet.

Vogel's first important discoveries are to be found in his paper (1863–1864) embodying his exhaustive researches on the action of light on chloride, bromide, and iodide of silver. In this paper the effect of light on the haloid salts of silver was most carefully described, and a number of new facts brought forward. In 1865 he made the important discovery that compounds, such as tannin, silver nitrate, mercury nitrate, tin salts, sodium arseniate, which readily absorb free iodine, act as sensitizers upon silver iodide. In 1872, after a series of experiments with sensitizers and preservatives, he brought forth his theory that substances which combine with iodine act as accelerators when they render the plate chemically less transparent, and *vice versa* bodies which act so as to render the plate less transparent play the part of accelerators, provided that they are capable of combining with iodine. One of Vogel's greatest discoveries, namely, that silver bromide could be made sensitive to the less refrangible rays of the spectrum, by staining it with certain dyes, was made in 1873. By this discovery Vogel showed that it was possible to photograph yellows as readily as blues. His theory of color sensitizing, which for a long time remained dormant, has, in many ways, changed the methods and practice of color photography; and although the problem of photographing in nature's colors is not yet completely solved, his discovery has indirectly rendered possible the reproduction of colored objects in hues very nearly those of nature. This discovery of Vogel's seems to have been partly accidental. He found that some collodio-bromide plates imported from England were more sensitive to the spectrum in the green at the line *E* than in the light blue at *F*. This action seemed to point to the presence of some coloring matter which absorbed the green rays. Experiments proved the correctness of his theory. He then tried whether the addition of a substance capable of absorbing the yellow rays, such as coralline, would increase the sensitivity of his bromized collodion to yellow. He found that it would do so. From these experiments he concluded that the sensitivity of a plate depended not only upon the optical absorption power of the silver salts, but also upon the optical absorption power of substances mixed with them.

Vogel was a skilled spectroscopist, and his analysis of absorption and emission spectra led him to researches in chromatics. Latterly he and his son were engaged in perfecting a system of three-color printing in conjunction with Kurtz, of New York.

We are indebted to the Illustrirte Zeitung for our engraving, and to Photography for our technical particulars.

THE GEOLOGY AND ARCHÆOLOGY OF THE CALIFORNIA GOLD FIELDS.*

By W. J. McGEE and W. H. HOLMES.

ACCEPTING the conclusions of Turner, Lindgren, and other geologists regarding the origin and age of the auriferous gravels, the authors described the deposits, the subsequent erosion by which they have been reduced to remnants, and the principal events in the geologic history of the region. Beginning with the base-leveled surface of the peneplain in early or middle Tertiary time, the region was apparently depressed and tilted westward in such a manner that a number of parallel streams (prototypes of the present waterways) clogged their channels with beds of coarse gravel derived from the ancient Sierra rocks; later vulcanism supervened, and some of the waterways were further choked by the ejectamenta in such a manner that tuff beds, interspersed with gravel deposits, were accumulated, while the accumulation ended, in some portions of the area, with outflows of andesitic and basaltic lavas. Afterward the region was lifted and profound canyons were carved by the rivers draining the western slope of the Sierra, most of the previous deposits were carried away, a few remnants only persisting in the form of table mountains, elevated tuff beds, and gravel streams generally overlain by lavas and tuffs, while in the typical part of the region the cutting extends from 1,000 to 3,000 feet below the Tertiary gravels, tuffs, and lavas, and into the obdurate rocks of the Calaveras and Mariposa formations. The fossils and relics derived from the gravel beds were described as (1) plants, (2) animal remains, (3) mortars, pestles, and other stone artifacts, (4) human bones. The plant remains have been found in limited quantity in a number of localities, usually in fine beds associated with the gravels and tuffs, and they indicate ages ranging from about middle Miocene to late Miocene or early Pliocene. The animal remains are much fewer, but their testimony as to age coincides with that of the plants. The stone implements all belong to a single cultural type—the type represented by the living Indians of the region (commonly known as Diggers), whose chief source of food is the acorn. Their habits of life, including most of their industries, much of their language, the essential features of their social organization, and the distinctive features of their religion are adjusted to this food source. They are as completely acorn Indians as the Dakotas were buffalo Indians, and the implements used by them to-day in making acorn meal are indistinguishable in material, form, and mode of preservation from those reported to have been found in the gravels associated with and commonly below the Tertiary lavas and tuffs. The only fully recorded occurrence of human remains in the gravels below the lava is the case well known to geologists as the Calaveras skull. This fragmentary cranium has not been examined critically by the authors, but comparison of Whitney's reproductions of the specimen with related material in the National Museum indicates that it is a normal Indian skull. The authors described their visit to the locality whence this specimen was reported, and their conferences with the dozen or more surviving miners and business men who were personally acquainted with the circumstances attending the discovery. Of these survivors, two held the skull to be a genuine fossil, while the others regard the affair as a joke, and several of them independently recount a history of the planting of an Indian skull, taken from the vicinity of a saline spring a few miles away, in the shaft to deceive a miner, and of later jocular conspiracies to deceive a local collector, and in turn the State geologist. Indeed, one of the most substantial and highly respected citizens of Angels (a leading merchant and the present postmaster) declares that the skull lay in his store for six weeks before it was planted in the shaft, during a midday nooning, as a joke on the miner, who innocently brought it to light on resuming work in the afternoon. Thus, so far as the contemporaneous human testimony goes, the record of the finding cannot be regarded as above question, and the authors pointed out the desirability of resting conclusion on the firm basis of observation and comparison, which any patient worker can verify.

Next the time scales or scales of serial development recognized by the geologist, the paleontologist, and the anthropologist, respectively, were outlined. The ordinary geologic time scale is a section or series of successive formations and unconformities, representing a succession of episodes in earth making; the paleontologic scale is commonly conceived in the form of a genealogic or rather a phylogenetic tree, showing lines of ascent of orders, a genera or species which may be adjusted to the geologic time scale; the anthropologic scale is best represented as a series of convergent lines showing the blending of activities in the four principal culture grades. Now, the scale of the anthropologist differs greatly from those of geologist and paleontologist, not only in its convergent direction, but even more in the rapidity of its development; and it was held to be inherently improbable—so improbable as not to be acceptable without abundant and unimpeachable testimony—that man, the most variable of all organisms, could have existed at a period so remote that no other animal species and few animal genera have survived, while even the most stable flora has been greatly modified. It was held even more firmly that, if Homo sapiens be admitted to have survived since the close of the Miocene, it is incredible that his skeletal characters should have remained so little modified as to permit identification of his cranium with that of the local modern tribes. Most firmly of all was it held to be incredible that the distinctive culture stage represented by the mortars and pestles of the present Californian Indians could have survived throughout the vast period represented by the volcanic overflows and the subsequent erosion of the profound Sierra canyons, with the concurrent transformation of floras—i. e., that an acorn culture could have begun at a time when the nascent Quercus flora was probably not yet fruit-bearing, and survived unchanged while the region was transformed from the Miocene peneplain to the present labyrinth of profound canyons.

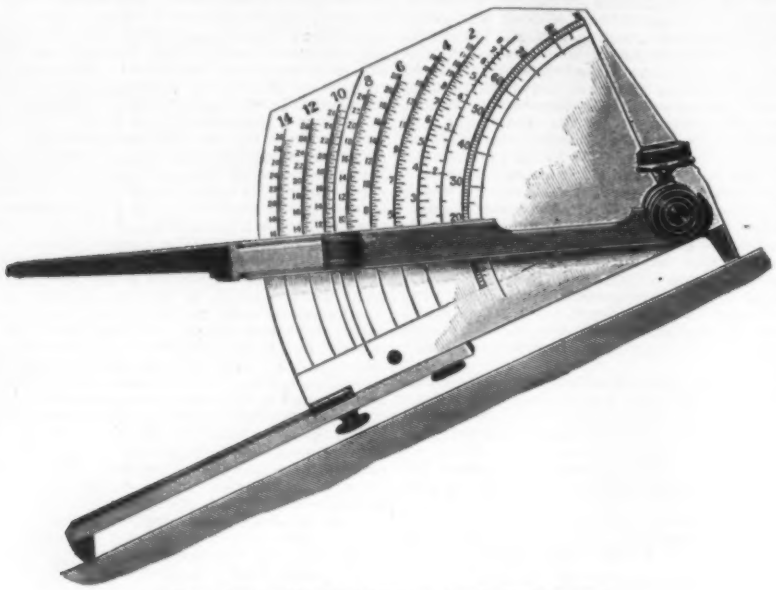
In answer to an inquiry as to the supposed cumulative character of the evidence offered by relics from the gravels, it was pointed out that nearly all of the records were made by inexpert observers or second-hand collectors, not guided by scientific principles; and it was shown to be natural, and even inevitable, that untrained observers should fall into error as to associations. The most common source of error was the misleading association produced in hydraulicking gravels buried beneath a heavy covering of tuff; in such cases a great part of the material washed into the sluice boxes really comes from far above the gravel horizon, some of it, indeed, from the surface. In one instance, the authors found more than a dozen mortars and a score of pestles within stone's throw of the cliff, formed by hydraulicking the great Dardanelles mine near Dow's flat, where relics had been reported by the miners. Indeed, in working down the cliff, they found a mortar lodged forty feet below the surface, a pestle twenty feet lower still, and near by another mortar on the bed-rock, all manifestly fallen from above. During their work they had been compelled to recognize a considerable number of possible sources of error, with respect to association, against which early observers had not guarded. The paper concluded with the explanation that the investigation was not yet complete, but that it would be continued along each of several special lines, all tending to elucidate the archæology of California.

In the ensuing discussion, Prof. W. H. Brewer and Prof. S. F. Emmons raised questions concerning the alleged fossilization of the Calaveras skull, which the authors were not in a position to answer, pending an examination of the specimen; though they mentioned finding partly calcified crania from caverns in the vicinity, where the Miwuhk Indians frequently disposed of their dead by casting them into the deepest caverns they are able to find. Major Powell noted the untrustworthy character of the testimony of unscientific men as to associations, instancing the Nampa figurine, alleged to have been found under the Tertiary lava sheet in Idaho, which a well operator sought to palm off on him as a genuine discovery, and which was afterward actually foisted on a credulous collector and published as evidence of high human antiquity. Prof. J. A. Holmes described the discovery of an object in Miocene deposits of the coastal plain, which was attested to be in place in the undisturbed formation by affidavits of all finders, including the army officer in charge of the work; the object proving, on examination, to be a piece of a revolver of rather recent make.

* Abstract of a paper read at the eleventh annual meeting of the Geological Society of America, at Columbia University, December 28–30, 1898.

THE CHAPMAN-HUNTER PITCHOMETER.

AN instrument for measuring the pitch of screw propellers, which we illustrate on this page, is put on the market by Messrs. Walker Brothers & Company, of 44 Constitution Street, Leith. The construction



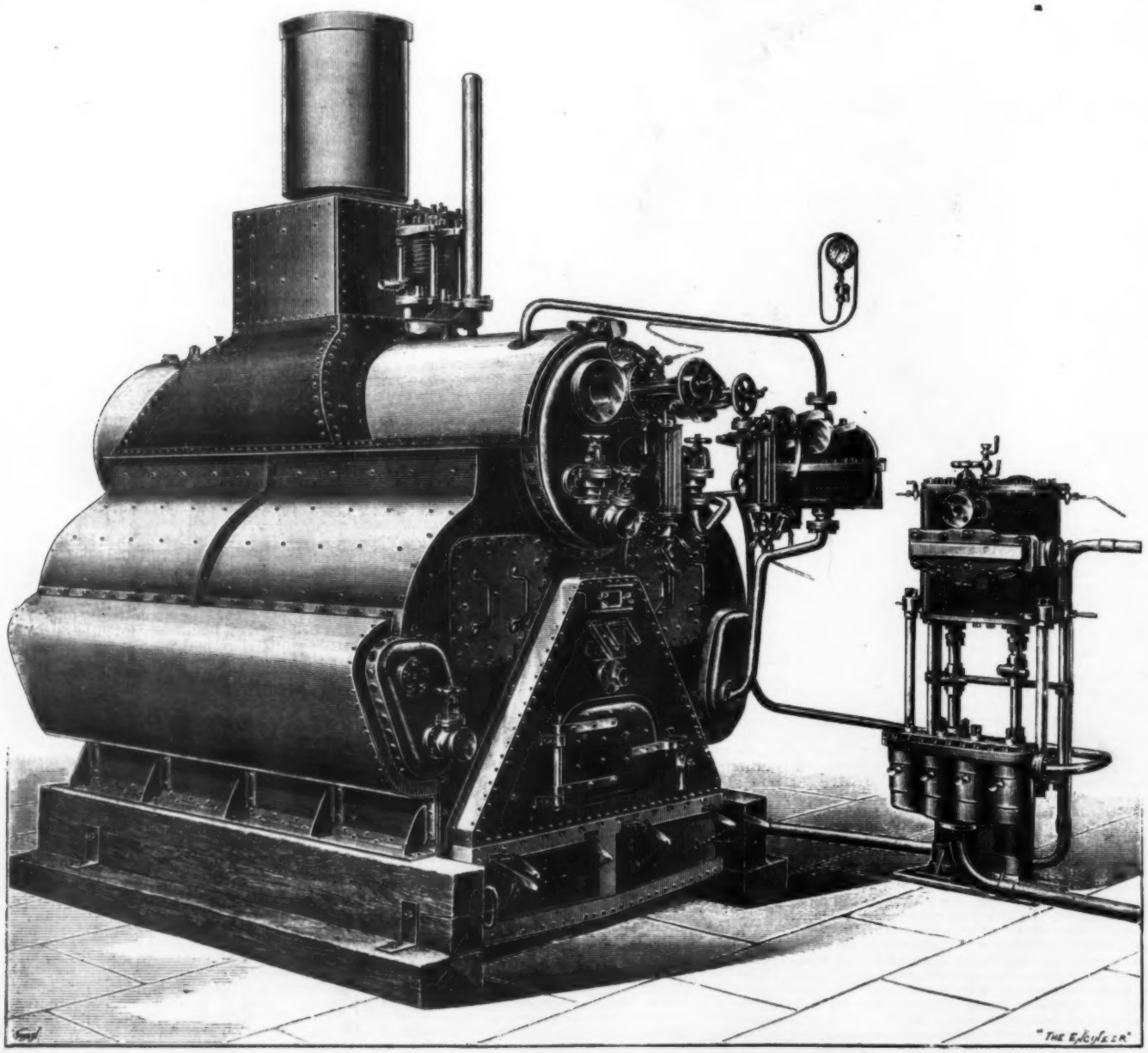
THE CHAPMAN-HUNTER PITCHOMETER.

of the pitchometer, as now made, is very clearly shown in our engraving. The instrument consists essentially of an engraved plate, having pivoted to it an arm as shown. At the pivot this arm carries a circular level, the position of which can be altered through any angle relatively to the arm. As shown in the engraving, its axis is perpendicular to the arm, and this is the position which it occupies when a propeller is being measured in the shop. To measure a propeller in place on its shaft, the level is turned round so that its axis is parallel to the length of the arm. To use the instrument in the shop the propeller is placed with its axis vertical, and the instrument applied so that the two projections shown rest on the upper face of the boss. One of these points, it should be noted, is carried on an extending arm, which allows the distance between the points to be varied as circumstances require. To continue, the next step in measuring the propeller is to draw lines on the blade at diameters of 2 feet, 4 feet, 8 feet, 10 feet, 12 feet, and 14 feet respectively. The instrument is then applied so that its points of support rest on each of these lines in turn; say, for instance, on that at 8 feet radius. This done, the pivoted arm is moved till the level bubble is central, and the pitch at this point can then be read off direct from the graduation of the arc marked 8 feet in diameter on the instrument. The operation is repeated to obtain the pitch at the other diameters marked on the blade. When the propeller is in place on its shaft, the measurement is made in a similar manner, save that the level, as already mentioned, is turned at right angles to its former position, and thus indicates when the arm is vertical, and not when it is horizontal, as in the previous case. The hinged portion of the arm is used when taking the pitch of a propeller in the floating dock or similar positions in which the level is not applicable. The procedure is then as follows: The radii being marked in the blade as already explained, the hinged portion of the arm is turned out at a right angle, and the whole adjusted till this arm is in "winding" with a straight edge applied to the boss at right angles to the blade. The pitch can then be read off from the graduated scales as before.

We are indebted to London Engineering for the engraving and article.

MUMFORD'S WATER-TUBE BOILER.

THE special type of water-tube boiler designed and constructed by Mr. A. G. Mumford, of Colchester, for the first-class torpedo boats Nos. 63 and 64, differs in several points, says London Engineer, from the boilers made by the same firm for the "Salamander," and illustrated by us on December 3, 1897. The main reason for the alteration in design was to accommodate the boiler to the smaller space allowed in the torpedo boats and the high efficiency required. An exterior view of the boiler is engraved below. The entire space occupied is—length, 9 feet; breadth, 7 feet; and height, 6 feet. The heating surface is 850 square feet and the grate area is 22 square feet. It was designed for 400 indicated horse power, but the results of the official evaporation trials proved that far greater power could be developed. Burning 25 pounds of coal, an evaporation of 9·88 pounds of water per pound of coal from feed water at 58° was obtained; burning 50 pounds, the evaporation was 9·05; 75 pounds, it was 7·4; and 100 pounds, 6·317, all from feed water at a temperature of 58°. These figures are unquestionably very good. Special attention has been given in this particular boiler to the reduction of the gases to a very low temperature, and by an ingenious arrangement this has been so far secured that the temperature at the base of the funnel never became excessive on the three hours' trials above recorded. It is unnecessary to add that the boilers are fitted with Messrs Mumford & Anthony's patent feed apparatus, which will be found fully described in connection with the "Salamander's" boilers.



WATER-TUBE BOILER FOR FIRST-CLASS TORPEDO BOATS.

HILL-CLIMBING MOTOR CAR TESTS.

THE hill-climbing tests of the French Automobile Club took place on November 27, and appear to demonstrate very considerable capacity on the part of many of the vehicles. The hill surmounted was that at Chanteloup, near Paris, the slope of which varies up to 11 per cent., or nearly so, or, as we should say, 1 in 9. The length of the hill is 1,800 kg.—a distance covered in 3 minutes 52 seconds by the winner, M. Jenatzy, with an electric carriage. The battery was very powerful. The total weight of car was 1,800 km., and over 28 h. p. was developed in places, which seems enormous, and Mr. Farman, to whose account in Industries we are indebted for the figures, considers any longer duration would have completely disabled the batteries, whereas petroleum cars would have gone on all right. Eleven of the contestants did the journey under 5 minutes, the remainder tailing off to a maximum of nearly 23 minutes. The second vehicle required only 10 seconds longer than the electrical car. It was a single-seat Bollée voiturette, and had a motor of 8 h. p. The speed of the winner was nearly an average of 30 km. per hour—a most respectable performance, as indeed were all the runs under 5 minutes, for they represent speeds of above 21 km. per hour, or about 14 miles. If autocars will run at this speed up grades of from 3 to 10 per cent. with motive power of reasonable dimensions, the future of such cars must be good. There were 45 vehicles in the competition, and over 200 vehicles present in all. Mr. Farman is himself a petroleum vehicle man, and may be biased against the electrical vehicle, which he affirms would have been disabled by an hour's similar contest. It must, of course, be some time before electrical vehicles can have so wide a range as petroleum cars, the success of which will not have a retarding effect on electrical cars, but, on the contrary, will tend to their extension and will assist to familiarize the public with motor cars generally.

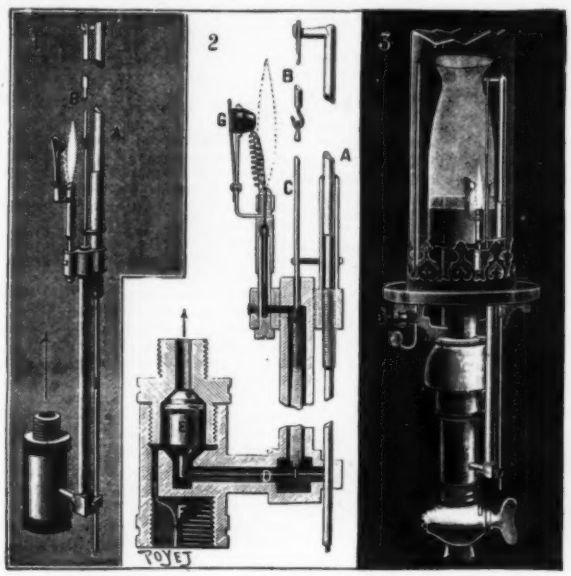
PORTABLE PETROLEUM ENGINE.

WE illustrate a portable petroleum engine, constructed by Messrs. Tangyes, Limited, Cornwall Works, Birmingham.

As seen, the engine is their well known oil engine, having a bed of special design, carried on a wrought iron carriage, which also forms the tank, and is fitted with four road wheels with wrought iron axles. It has also a swiveling fore carriage and shafts for horse traction.

The engine is designed to give 6 brake horse power in regular work, and is tested to a maximum of about 25 per cent. above this power. Its special feature is the water cooling arrangement. A small rotary pump, fixed on the side of the engine, is driven from a pulley on the crankshaft and draws water from the tank forming the base of the engine; it then forces the water through the cylinder jacket and thence through a pipe from the top of the cylinder to a pipe inside the canopy on the roof of the carriage. This pipe has a number of small holes through which the water is forced against the top of the canopy; it then trickles down the sides, which, being perforated, allow the water to come into contact with the atmosphere. The cooled water then collects on the roof of the carriage, and drains back into the tank. The tank contains sufficient water for an ordinary day's run without refilling.

The lamps for heating the vaporizer and ignition tube are inclosed in a large box which effectually prevents them being blown out, even in a strong gale. The lamps are supplied with oil from a small reservoir, fitted with a pump by means of which the oil in the reservoir is kept under pressure. This only requires pumping up a few times a day. The engine is fitted with the necessary scotches and brake for easy handling when being moved about.—Engineering.



AUTOMATIC LIGHTER FOR GAS BURNERS.

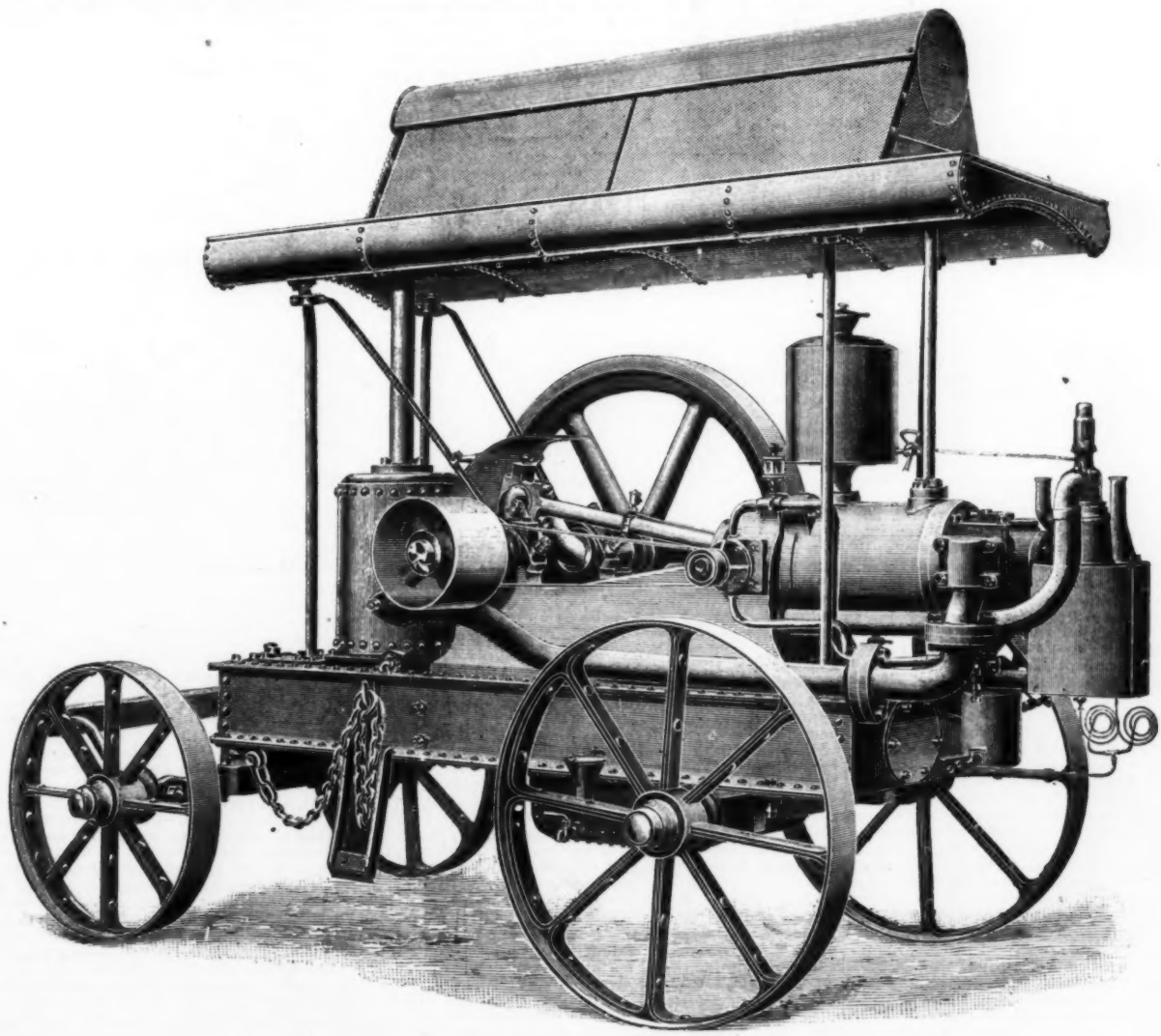
AUTOMATIC LIGHTER FOR GAS BURNERS.

WE illustrate herewith a new style of automatic lighter for gas burners, described by our contemporary La Nature. In No. 1 of the figure are shown different parts of the apparatus, and in No. 2 the details of the same, and in No. 3 is represented the apparatus as a whole mounted upon an Auer burner.

The apparatus comprises a coupling screw for fixing it upon the gas pipe, and within this is inclosed a distributing valve, *E*. The gas enters in the direction shown by the arrow, *F*, and, according to the position of the valve, *E*, flows to the upper part or into the lateral conduit. This latter is connected with a vertical pipe in which moves a rod, *C*, held by a wire, *B*, which is fixed to a small support, *A*. At its lower extremity, the rod, *C*, actuates a horizontal rod, *D*, which is connected with the valve, *E*. At the side of the vertical tube there is a lighter composed of wires and a block, *G*, of a special substance (divided platinum or palladium), which becomes red hot in contact with the gas under pressure, raises the coils of platinum wire to incandescence, and ignites the gas.

The operation of the apparatus is, from this, easily understood. When the burner is opened, the gas enters *F*, passes into the lateral conduit, reaches the lighter, and impinges upon *G*, which becomes red hot and raises the platinum wires to incandescence, and these, in a second or two, ignite the gas of the lighter. The latter produces a certain amount of heat, that acts upon the wire, *B*, and causes it to expand.

The wire, therefore, plays here the part of a pyrometer. The rod, *C*, then displaces the horizontal rod, *D*, which carries the valve along with it. The latter, in setting upon its seat, gives free passage above to the gas, which becomes immediately ignited in contact with the lighter. At the same time, the gas no longer enters the lateral conduit, and the lighter is therefore extinguished.



PORTABLE OIL ENGINE.

ENGINEERING NOTES.

At San Antonio, Texas, cedar sleepers have been found in perfect condition after 20 years. In a moist climate cypress lasts as well as cedar, but in a dry climate they are no better than sap-pine. Heart-pine lasts from 5 to 8 years, cedar from 25 to 30 years. Heart-pine would probably last well if treated with carbolinum.

A steel roadway, about 150 feet long, is being laid at the Minnesota Agricultural Experiment Station, says Municipal Engineering. The steel rails are 8 inches wide, with half inch flanges at the outer edge, and are 30 feet long. They are made of quarter inch steel, with cross ties every 6 feet buried about a foot. On the ties are timber strings on which the rails lie. The width of the 8-inch rails takes in wagons on any width of tires. This demonstration of the steel roadway is being made in order to try to show its advantages over the ordinary macadamized road. It is asserted that such a road costs $2,500 a mile, while a macadamized road costs from $3,000 to $6,000, and that the steel road will outlast the macadamized and be far more serviceable.

During the year 1898, approximately 3,000 miles of new railroad were built in the United States, the largest mileage since 1892, when it exceeded 4,000 miles. The two journals which make a practice of compiling statistics on railway construction are The Railway Age and The Railroad Gazette. The former puts the mileage of new construction for the present year at 3,018 and the latter at 2,867. According to the figures of The Railway Age, Minnesota leads the list with 250 miles; Texas, 183; New Mexico, 163; Louisiana, 158; Arkansas, 157; Alabama, 154; Oklahoma, 147; and Maine, 124. The Great Northern Railway is credited with the largest increase—146 miles. The greatest activity in railway construction was in the South and Southwest, where fifteen States built nearly half the total mileage. Only five States built no railroad during the year—New Hampshire, Massachusetts, Rhode Island, Kansas, and Nevada.

All who are interested in our naval and mercantile marine, says The Trade Journals Review, will look forward with interest to the result of the experiments which are now being conducted at Fiume with the new brake for steamships, which is the invention of an Italian scientist. If it be true, as alleged, that a steamer of 2,000 tons can have her progress suddenly arrested, and even pulled up to a dead stop within thirty seconds, we may count upon the possibility of averting collisions at sea altogether, except, perhaps, in cases of exceptionally dense fog. We presume that the brake will be applicable even to large warships, although in such cases its power would require to be augmented proportionally. Without knowing anything of the details of this invention, we can readily believe that a powerful drag on a ship's forward movement is within the range of practicable application, and that without forming any impediment to the working and management of a vessel.

There are not many planing machines that are fitted with any arrangement for lifting the tool off the work when the table is running back. As a rule, the steel is allowed to drag over the surface after each cut and to fall by gravity into its position just before beginning a fresh cut. Every planer knows that this dragging on the back stroke is injurious to the tool. Small cuttings get under it, and fine dust grinds under the cutting edge, and this kind of usage soon spoils it for service until it is taken out and reground. We notice in a contemporary a very simple contrivance, which can be applied to any planer, to effect the lifting of the tool during the back stroke. A set screw is fixed on the rocker lever and a strong cord attached thereto. This cord is carried down to go under a small sheave fixed on the ground on to another sheave behind the standard, and from that point is carried up to the beams overhead on other two pulleys and brought down in front of the machine. There the other end of the cord is attached by a simple hook to the lower part of the hinged tool holder. It is easy to understand the action of this. When the rocker lever receives the kick at the end of the cut, the tool is lifted a little by the lever's movement and the work travels back without being touched by the tool. At the end of the back stroke, the rocker being kicked on the other side, the tool is allowed to resume its cutting position and the cut goes on. The attachment to the tool holder can easily be unhooked and the cord hung up when not required. A simple device of this kind, costing very little to rig up, will be sure to save much time and trouble in keeping the steels in good order.

The old adage that necessity is the mother of invention has just been illustrated in Sydney, where the long-vexed problem of remuneratively navigating the shallow inland streams of New Zealand has been solved, says The Syren, by the construction of a peculiarly shaped vessel, the first of its kind seen in Australasia, having a speed of 11 knots, and drawing only 6 feet 6 inches when fully loaded. The new vessel is an adaptation of those characteristic of the gun and other boats on the Nile, and also the shallow waters in India. In the vessel which has been successfully launched in the New South Wales metropolis, the stern takes the shape of a long gradually rising tunnel, highest immediately over the propeller, thence gently sloping toward the load water mark at the extreme after end. This tunnel is in the shape of a half cylinder, the edges being always under water, the interior top of the arc being a foot above water when the vessel is fully loaded. The propeller runs through the center of this semi-cylinder, and when the boat is stationary, the top of the screw is some little way out of the water. As soon as the engines are started the air in the semi-cylinder is expelled and replaced by water, in which the propeller works as efficiently as in vessels of heavier draught. The loss of efficiency in light craft is mainly occasioned by the propeller taking down air, which is prevented in the tunnel-like arrangement of the new vessel. The Aotea, as the vessel is named, has a length of 126 feet 6 inches, with 24 feet 7 inches beam, and 13 feet 3 inches depth of hold. She is provided with all the requirements of a first-class intercolonial steamer. The deck, which is unbroken, forms a broad promenade, giving a walk of 100 feet clear of everything. In addition to coal, water, machinery, and other dead weights, over 50 tons of cargo can be shipped.

MISCELLANEOUS NOTES.

A mixture of 3½ volumes of acetylene gas with 96½ volumes of air is explosive, but the maximum explosive effect is produced with 1 volume of acetylene and 12½ of air. According to Prof. Vivian Lewes, liquefaction of acetylene takes place at a pressure of 21½ atmospheres.

One of the most valuable properties of aluminum is that it resists well the action of acids, and is, therefore, well suited for laboratory instruments. This metal is almost as indifferent to acids as platinum. It can remain without apparent effect for days in the most concentrated nitric acid, and it may be imagined that this property is very valuable. Pliers of aluminum are now much used to withdraw photographic plates from acid baths.

Although the striking back of acetylene burners has been denied, the controversy cannot be regarded as settled. Such a striking back would have to be feared in all cases where a mixture of air and acetylene is contained in the gas pipe or other parts. That mixture may form on opening the burner before opening the main, when the generator is cleaned, when the gas pressure in the main becomes strongly reduced for some reason, and in other cases. A small explosion in the gas pipe is not much to be feared, but if the flame extends to the generator, the consequences may be serious. Berdenich, who first pointed to this source of danger in connection with one of the explosions which happened at Totis, has constructed a simple non-return valve. In the case of burners, this valve consists simply of two flat pieces of wire gauze; for large pipes, conical pieces are used. The space between the pieces of gauze is packed with asbestos fiber or asbestos texture, glass wool, etc.

The Prussian state railroads have just adopted new rules for the transportation of bicycles, says The Engineer. The charge for all distances is 50 pfennigs—12 cents—which is paid at the ticket office for a "bicycle ticket." On receiving this ticket, which is given only with a ticket for passage, the holder, at least fifteen minutes before the train starts, must take the wheel to the luggage office to be labeled with the name of the station to which it is going. Lanterns and all luggage except the tool-bag must be detached. Then he must himself take it to the platform. There a luggage man receives it and gives the cyclist a check, which declares that the company is not responsible for damage to the unpacked wheel. In case of changing trains, the wheelman must himself transfer his machine from one train to the other. The bicycle ticket, as well as the passage ticket, must be presented to be punched at the platform gate, and only on presenting it at destination is the wheel delivered. Altogether the system seems likely to end in confusion.

Some curious particulars regarding the presence of bacteria on ancient bronze implements has lately appeared in Nature. The disease makes its appearance in the form of small excrescences, which are centers of rapid oxidation. On scraping off a little of the material from these points it is found to be swarming with bacteria. This "Ulcerative Disease of Bronze," or "Bronze Canceroid," as it has been called, has been described by Dr. W. Frazer, in The Journal of the Royal Society of Antiquaries of Ireland. According to this authority all objects of antiquity fabricated from metallic copper, and its important alloy, made by adding tin in certain proportions, are liable to be attacked by this destructive corroding affection. The bronze disease produces a remarkable disintegrating effect on the object it attacks, and there are good reasons for considering it possesses infective powers, spreading like leprosy through the substance of the metal, and slowly reducing it to an amorphous powder. Further, there are substantial grounds for believing it capable of being conveyed from surfaces already suffering with it to those yet uninfected. This sign of antiquity has not been overlooked by the counterfeiters of such objects, and we are told that skillful artists of these false antiques are known to inoculate their productions with spots of the bronze disease.

An interesting paper on Japanese swords, by Mr. Gilbertson, appears in the last volume of the Transactions of the Japanese Society, says The Engineer. The blades are made from metal, chiefly the deposits of magnetic iron ore and ferruginous sand, and in the opinion of many experts no weapons are superior to those produced by the Japanese. The art of making the blades was at one time a secret, handed down from father to son, and master to pupil. The mode of manufacture is as follows: A strip of steel is welded to a rod of iron which serves as a handle. A number of other strips of steel are then welded on the first until the mass measures 6 inches or 8 inches in length, 1¼ inches to 2¼ inches wide, by ¼ inch to ¾ inch thick. When raised to a suitable heat, this bar is doubled in half and then beaten out to the original dimensions. This process is repeated fifteen times. Four such bars are made, welded together, then doubled over, again welded and forged as before five times. So thin are the original strips of steel, and so often are they doubled over, that it is estimated that a Japanese sword blade consists of 1,194,304 layers of metal. The bar is then beaten out from the 6 inches or 8 inches to the required length. Sometimes in the forging process the metal is hammered on the edge, and the instruments, instead of being all steel, are alternately a layer of steel and one of iron—a combination which produces beautiful markings representing fine wood grain or wavy lines. When the blade is complete it is scraped with a knife, and the tang—that part inserted in the hilt—is shaped. The blade is then roughly ground, and if the smith is satisfied with it, he generally signs his name upon the tang. Now it is ornamented, and the process is interesting. The blade is thickly coated with a mixture of clay, fine river sand, and finely powdered charcoal. When this coating is nearly dry, a design is traced upon it, cutting through to the blade. The weapon, when the coating is properly set, is plunged into a specially prepared fire, and when sufficiently heated—only by long experience can a man judge this—it is dipped into water or oil. The operation of sharpening in the case of a very fine blade sometimes requires fifty days to finish, the surface being gone over as many as twenty times. Finally, the blade is most minutely examined by the owner or by an expert.

SELECTED FORMULÆ.

Sensitized Paper.—This formula is recommended:

Silver nitrate	5 drachms.
Distilled water	5 ounces.
Nitric acid	2 drops.
Kaolin	1 ounce.

Dissolve the silver nitrate in the water, and then add the acid and kaolin; the kaolin will not dissolve, its use being to prevent the solution becoming discolored after using. This solution will not require filtering; it must be allowed to settle until quite clear, and when required for use decanted carefully, leaving the kaolin in the bottle; after using the solution should be returned to the bottle and well shaken with the kaolin, which will carry down the coloring matter as it subsides. As this solution rapidly becomes weaker by using, it should be tested occasionally, and sufficient silver nitrate added to restore it to its proper strength (60 grains to the ounce).

Ferro-Prussiate or Blue Print Paper.—

1. Red prussiate of potassium	1 av.	ounce.
Distilled water	10 fl.	"
2. Citrate of iron and ammonium	3 av.	"
Distilled water	10 fl.	"
Gum arabic or dextrin	.120	grains.

Keep these solutions in separate well stoppered amber-colored bottles. In using, mix equal parts of Nos. 1 and 2. In preparing the sensitized paper, take a solid, firm paper, free from impurities, and apply the solution to the surface of the paper with a soft sponge or a broad, soft brush, being careful not to have the sponge or brush charged too heavily with the solution, or else the paper will have a streaked appearance, which will show in the finished print. Go over the surface of the paper in two directions at right angles to each other, so as to insure an even coating. The paper must be allowed to dry in the dark and in a horizontal position.

Process for Producing Blue Lines on a White Ground.—

1. Iron citrate, soluble	96	grains.
Distilled water, enough to make	1	fl. ounce.
2. Red prussiate of potash	72	grains.
Distilled water, enough to make	1	fl. ounce.
3. Potassium bichromate	5	grains.
Distilled water	1	fl. ounce.

Mix Nos. 1 and 2, add No. 3; filter quickly, and use immediately. The iron citrate should be in scales, free from powder, and should not have been exposed to light. The prussiate must also be free from any adherent powder.

To Coat the Paper.—This must be done by gaslight. Pour some of the solution into a saucer, dip a soft pad of absorbent lint into it and pass quickly across the paper. When all the paper has been thus coated, take a brush and remove the excess of liquid.

This process gives blue lines on a white ground, instead of white lines on a blue ground, as in the ordinary blue print. The sensitive paper is prepared by treating with a solution prepared by mixing the three following solutions:

1. Ferric chloride	2½	ounces.
Water	5	"
2. Acacia	6	"
Water	28	"
3. Ammonio-citrate of iron	4	"
Water	10	"

This mixture must be used at once, as it spoils. The "printing" is done in the usual manner, but does not require as long exposure as the usual process. To develop the print, dip first in a saturated solution of ferricyanide of potassium, transfer to a bath of pure water, and thence to a mixture of hydrochloric acid, 1 part; water, 12 parts. Finally, wash well with pure water.

To Silver Cast Iron Direct, Without a Battery.—Cast iron may be silvered without the intervention of copper or other primary coating by proceeding as follows: Dissolve 30 parts of crystallized silver nitrate in 150 parts of distilled water. Dissolve 60 parts of potassium cyanide (commercial 75 per cent.) in 100 parts of water and mix the solutions. Dissolve 50 parts of sodium chloride in 750 parts of distilled water, and to the solution add that of the silver cyanide, in a thin stream with constant agitation. Plunge the iron to be silvered in nitric acid of 1·20 s. g., and let remain for four or five minutes, and remove directly from the bath, after letting drain to get off surplus acid, into the silvering solution. Silvering is instantaneous, but the metal may be kept in the fluid for a few minutes. Remove, rinse, and with a burnisher rub down the surface.—National Druggist.

Floor Polish.—The Suddeutsche Apotheker Zeitung gives the following:

Shellac	1500 parts.
Gum anine	525 "
Rosin	350 "
Alcohol, 95 per cent	6000 "
Yellow ocher	1500 "
Umber	100 "

Mix.

To Make Plaster of Paris Set Slower.—It is said that the setting of plaster of Paris may be retarded by the addition of two to four per cent. of powdered althea root. This addition not only retards the hardening of the plaster, but also enables it to be cut, filed, sawed, and turned. An addition of 8 per cent. retards the complete setting of the plaster for about an hour, so that the mass may be used for any purpose where it is to remain plastic during at least a portion of that time. In the manufacture of cements for plastering and other purposes in which plaster of Paris is used, we are told that the rapidity of hardening is regulated by the addition of "overburnt" gypsum, blanc fixe, slaked lime, sand, etc., as determined by the kind of plaster the operator desires to make.

The artificial or precipitated sulphate of lime may be prepared by precipitating calcium chloride with dilute sulphuric acid. The artificial salt is largely used by paper manufacturers as a filling for writing paper, etc., under the name of "pearl hardening."—Pharmaceutical Era.

MIRAGE.*

WHEN a ray of light passes from point to point of a medium which is everywhere similarly constituted, its path is a straight line; when it passes from one medium to another medium of different density, then the ray of light is refracted or bent at the surface which separates the two media. When the ray passes from one medium to another which is denser, the refraction or bending is always toward the normal to the surface separating the two media at the point of incidence; when, on the other hand, the ray passes from a medium of a certain density to one of less density, then the bending is always from the normal to the common surface at the point of incidence. The earth is surrounded with a spherical envelope of air, and if that air were always of the same density everywhere, its refractive index would be the same, and there would be no terrestrial refraction. But the spherical envelope which surrounds the earth is not all of the same density, and the refractive index of the air varies with the density.

There are two causes, in the main, which militate against the uniform density of the atmosphere; one is barometric pressure and the other is temperature. Taking no account of temperature for the moment, taking merely as the cause barometric pressure, the density of the air diminishes gradually upward from the surface of the earth, so that the refractive index of the air diminishes upward. The diminishing of the refractive index is not absolutely proportional to the decrease of density, but it is found by experiment to be sensibly proportional to the excess of the density over unity.

The circumstance of normal refraction in the British Isles, as regards temperature, is that there is a gradual diminution of temperature upward at the rate of about 1/300° F. for every foot of ascent. As the air gets cooler the density increases, so the tendency is to some extent to counteract the effect of barometric pressure, but it does not altogether do so. The result in the normal refraction of the British Isles is that there is a gradual diminution of density upward.

We may consider the air to be stratified in horizontal layers; as a matter of fact, it is stratified in spherical layers, but it will simplify matters to consider it stratified in horizontal layers, the more so as the sphericity of the earth, though it is a slight cause of terrestrial refraction, is not by any means the chief cause; terrestrial refraction would still exist if the earth had no sphericity, and its surface were perfectly plane. I show you here a diagram representing the normal state of the atmosphere, and showing the curvilinear path taken by a ray of light when it passes from one point of such an atmosphere to another point horizontally distant from it. The reason a curved path is taken is this: Supposing the ray to have a general direction upward, and supposing it to have been inclined at incidence at a certain angle with the normal, as it is going from a medium—air—to air which is less dense, it bends away from the normal, and, therefore, there would be a successive bending away from the normal at each layer, until finally the ray would arrive at the highest point in the diagram. Then, if it were to pass downward, it would be passing from a medium of a certain density to one of a greater density, and it would approach the normal at each surface of separation of the media, and, therefore, its path would be a curved path presenting concavity downward. A ray of light will actually take some such path, because by curving upward it takes the path which it can pass over in the least time.

Generally, a ray of light takes the minimum path as regards time, and it is found to curve up into the layers of air which are of less density, because it can traverse them with greater velocity. It is important to notice that a ray of light always presents the concavity toward the denser layers; and there is another principle, that the amount of curvature of the ray, i. e., the total bending that there is in the ray over a given length of ray, is directly proportional to the rate at which the density changes along the normal to the direction of the ray. For instance, if we take a vertical line, the normal to the direction of the ray is horizontal, and there is no change of density in that horizontal direction, and accordingly there is no bending of the ray; if, on the other hand, the general direction of the ray is horizontal, the normal to the ray is vertical, and that is the direction along which there is maximum change of density, and, therefore, in that case you will get maximum bending. We get, then, the two cases: when the ray is vertical there is no bending, no curvature; when the ray is horizontal you get maximum curvature; and for intermediate directions you get intermediate amounts of curvature.

I was first led to look into this subject by considerations which arise in discussing certain questions respecting artillery firing, and I propose to give you some results which I have obtained in order to show the effect of refraction upon artillery fire. A mile on the earth's surface subtends at the center of the earth an angle of about 52"; the refraction will have a mean angle of about 4", a minimum value of about 2½", and a maximum value of about 8"; and taking a range of three miles these values of the refraction would become 12", about 8", and about 24" respectively; and very exceptionally the refraction would amount to about 1' 18". The meaning of this, in regard to artillery fire, is that (taking this exceptional amount of refraction), if the tangent sights of the gun were laid upon an object at that distance, they would be really laid at an elevation 1' 18" too much, and correction for terrestrial refraction would consist in depressing the gun through an angle of 1' 18". That is not a very important matter from an artillerist's point of view, because guns can only be laid properly to within about 5'.

There is also the question of determining the range. That can be done from an elevation by an instrument called the depression range-finder. If we take the range of an object by means of this instrument the terrestrial refraction would give a longer range than we ought to have, and the necessary correction would diminish the found range.

I now come to other cases that may present themselves in the density of the air. The case that we have considered already is that of the temperature diminishing gradually upward at the rate of 1/300° F. for every foot of ascent; in Great Britain the diminution is seldom more than about 1/130° or less than 1/400° F., but in other climates it is different. If the temperature were to fall at a more rapid rate the air would be very much more nearly of uniform density, and that would result in a smaller curvature of the ray. If the fall were at the rate of about 1/80° F. for every foot of ascent, it would result in the density of the air being uniform, and there would be no terrestrial refraction at all.

A more rapid fall of temperature still would cause a rise of air density upward, and that would cause a curved ray with the concavity presented upward. In such a case the refraction is said to be negative, whereas in the case that we had formerly the refraction is said to be positive. On the other hand, a rise of temperature upward causes a rapid diminution in air density in ascending, and the ray with the concavity presented downward is then more curved; and in the extreme case in which the rise of temperature upward is at the rate of 1/16° F. for every foot, the curvature of the ray would be the same as that of the earth, and in that case—which, of course, would never actually present itself—we should be able to see completely round the globe, simply because the ray would encircle it. Again, climatic conditions may lead to another distribution of the density. There might be a gradual rise in density upward to a certain stratum of maximum density, and then a diminution of density upward, in which case the ray of light would pass in a curious sinuous path with the concavities presented toward the denser layers.

[Major MacMahon here enumerated conclusions, relating to terrestrial refraction in the plains of India, drawn from the experiments and observations of the late General J. T. Walker, R.E., formerly superintendent of the Great Trigonometrical Survey of India, from which it appeared that the circumstances mainly affecting terrestrial refraction were in order of importance as follows: (1) The time of the day, (2) the temperature, (3) the aspect of the sky, whether cloudy or sunshine, and (4) the humidity of the air.]

Before proceeding to the next part of my subject, I will mention the well known case of astronomical refraction—the circumstance that during a total eclipse of the moon the whole disk of the moon is not obscured, the fact being that the rays of the sun in passing through the atmosphere of the earth are refracted toward the normal, and in that way some light does get upon the surface of the moon.

I come now to that effect of extraordinary refraction which is more especially termed mirage, and which was first noticed, so far as we know, by the French army under Napoleon. The conditions favorable to mirage are generally a very hot sun and a sandy soil, which becomes very hot under the influence of the sun, and an almost total absence of wind. Under these circumstances there is an extraordinary amount of negative refraction, the rays are very much curved, and the concavity is presented upward. An illustration which is familiar to everybody, because it occurs in many books on physics, is that in which the observer sees the top of a tree by means of a negatively curved ray, and it accordingly appears to him to be in the direction of the tangent to the ray where it enters the eye; the other points in the tree he sees in other directions, and altogether the tree appears with an inverted image below it. Not only so, but where there is a very clear sky that also is refracted down, so that the tree appears in the midst of an inverted image of the sky, which has very much the appearance of water. This phenomenon is very common in Egypt. In Egypt there is very often a great quantity of sand with villages dotted about, these being somewhat raised in order to escape the periodical inundations of the Nile, and the effect to an observer is that of a number of raised villages in the midst of what appears to be an enormous lake. The illusion is increased by two circumstances: First, that by reason of the great heat of the sand there is a considerable convection of heated air upward, which gives the air that peculiar rippling appearance, causing the refracted sky to look like ruffled water; and second, that the general direction of the ray is very similar to that of a ray reflected by a horizontal mirror placed upon the ground. This phenomenon is also common in Australia and in the plains of India, in the low-lying fen districts of England, and on the shingle ranges at Lydd.

One very curious thing about mirage is that it depends very much upon the position of the eye; a few inches in the height of the eye may make all the difference. I remember myself, on the plains of India, observing a mirage which was only evident when I was at a particular height; there was only a vertical space of two or three inches in which the effect could be seen, so that these phenomena may easily escape notice. A singular effect may sometimes be observed at a particular spot on the south coast, and very likely at other places; when the waves come in on to a very hot beach, if you place the eye within about a foot from the ground and look parallel to the wave fronts, you can see an image of the wave two or three feet above the real wave. This may conceivably arise in this way: The wave may bring in some cold air, and if the wind were blowing a little off the heated beach there might be some heated air brought in as a layer above that cold air; that would give that rapidly diminishing density upward which gives a ray with considerable curvature and with concavity presented downward, and would certainly result in an image of the wave above the real wave.

I should like to mention a case of refraction observed on the artillery ranges at Lydd, which has given rise to some controversy. An officer was firing on a hot, sultry day, from an ordinary Maxim machine gun at a target about 600 yards distant, and as the firing went on he saw a great wedge-shaped gap in the top of the target, and he thought that the hail of bullets had beaten down a part of the target. To his astonishment, however, when the firing ceased the gap disappeared, and the target appeared intact and undamaged. I imagine this to be an effect of mirage. I conclude that he was looking over the gun through the heated gases rising from the muzzle, which formed a medium of gradually increasing density upward; he was observing the upper portion of the target through this medium, and I have no doubt that that caused negative refraction, bending the rays so that the sky above the target was seen in the shape of a wedge, something like the shape of the vertical section of the rising gases. I have discussed the matter with physicists, and some agree with me, but other physicists of note do not accept the explanation which I have given.

I now pass on to another part of the subject, which is called "looming." Distant objects are said to "loom" when they appear in positions much higher than their actual positions, that is to say, when images of them appear considerably raised above their true positions. The effects of looming are very extraordinary, and I have some slides to show you which I have prepared from examples recorded by Commander William Scoresby, who went on his third voyage in his ship the "Baffin" to the Greenland whale fishery in the spring of 1822. The first of these views includes several large, irregularly shaped icebergs, which must cause very unusual distributions of air density, and gave rise to quite remarkable vertical and lateral refractions. In the second there are images of ice which was quite out of sight or quite beyond the horizon. There was extraordinary vertical magnification; small hummocks of ice were drawn out into spires, sometimes of a castellated shape and sometimes having the appearance of naked trees; at other times there appeared to be a city of ice, with public edifices, spires, etc., and Commander Scoresby states in his book that these effects were constantly changing, and were never the same for two minutes together. The first of these drawings, which you saw on the screen, showed a curious inverted image of a ship in the sky, raised considerably above the horizon; that ship was so distant that it could not be seen with a powerful telescope.

During the Crimean war observers, on one occasion, saw the whole of the British fleet inverted at a considerable height, an illustration of which appeared in The Illustrated London News at the time. Some very interesting cases were recorded by Dr. Vince, in the Bakerian lecture of 1798, read before the Royal Society, some of which are delineated in the succeeding slides. He remarks upon these curious phenomena that he thinks that in cases of national emergency certain people should be told off with telescopes to look out for the enemy's ships, and to search the horizon to see if they could detect any ships looming. Dr. Vince mentions another remarkable instance in which he saw Dover Castle from Ramsgate, at a point from which the whole of the keep of the castle cannot be seen, the four turrets only being visible.

The most curious case of lateral refraction that I have been able to discover was observed at Geneva, in 1818, by M. Jurine. A bark was seen approaching on the left bank of the lake, and at the same time an image of the sails was observed above the water, which, instead of following the direction of the bark, separated from it and appeared to approach Geneva by the right bank of the lake, the image moving from east to west while the bark moved from north to south. This case was brought to the notice of Biot, the physicist, and he, in one of the scientific journals, gave a very long explanation. He came to the conclusion, from the geographical features, and climatology, and the direction in which the sun's rays were passing at the time of the observation, that there would be considerable lateral difference in the temperature—quite sufficient to produce this phenomenon of lateral refraction.

Another case of curious refraction has been noticed by many people—I have seen it myself, particularly on the coast of Norway. Low lands and the extremity of headlands, or points forming an acute angle with the horizon of the sea, and viewed from a distance beyond it, appear elevated above it, with an open space between the land and sea, the effect being proportional to the amount of evaporation taking place at the surface.

Fata Morgana is a name given to an optical phenomenon sometimes seen in the Straits of Messina, between Sicily and the Italian coast. Minasi says:

"When the rising sun shines from that point whence its incident ray forms an angle of about 45° on the sea of Reggio, and the bright surface of the water is not disturbed either by wind or current, the spectator being placed on an eminence of the city with his back to the sun and his face to the sea, on a sudden there appear in the water various multiplied objects, namely numberless series of pilasters, arches, castles, columns, towers, palaces with balconies and windows, valleys of trees, plains with herds and flocks, etc., in their natural colors and proper action, passing rapidly in succession along the surface so long as the above-mentioned causes exist. If, in addition, the atmosphere be highly impregnated with vapor and dense exhalations not previously dispersed by the action of the wind and waves, or rarefied by the sun—in this vapor, as in a curtain, to a height of 24 or 25 feet, and nearly down to the sea, the observer sees the same objects, not only reflected from the sea, but likewise in the air, though less distinct. Lastly, if the air be hazy and slightly opaque and dewy, the objects appear only at the sea surface, but with prismatic colors."

He endeavors to prove that they are representations of objects on the two coasts. He considers the sea an inclined speculum, on account of the rapid current which runs through the straits, and divided into different planes by contrary eddies, and he ascribes the aerial morgana to the refractive and reflective power of matter suspended in the air.

Lastly, I would mention the experiments of Wollaston upon the subject of refraction and mirage. First, he says, into a square vial containing a little clear sirup put an equal quantity of water, in such a way that it floats without mixing, and after a little time, by mutual penetration, you see effects. If you view through the sirup a card with a written word upon it, you see it, and also above it an inverted and erect image of the same. That is a case in which the density diminishes upward, and the ray has its concavity presented downward. Then, above the water, he placed rectified spirits of wine, when the inverted and erect images were seen below, these appearances continuing many hours and even days, and he carried out similar experiments with water at different temperatures. Everybody knows the experiment with a red-hot poker. The effects of mirage can be seen by looking along the surface of a red-hot poker, held at a distance of about a foot from a sheet of paper, when there is perceptible refraction. Again, Wollaston looked along a horizontal plate of glass upon which he poured

* A lecture, delivered at the Camera Club, by Major P. A. MacMahon, F.R.S.—From Nature.

ether, and a line appeared instantaneously upon the opposite wall at an elevation of half a degree, this effect being due to the cold caused by the evaporation of the volatile liquid. Finally Brewster showed that all the phenomena of unusual refraction might be observed by holding a heated iron over a mass of water bounded by parallel plates of glass, and then substituting a cold body for the hot iron.

IRON PRODUCTION DURING FORTY YEARS.

IN a recent issue of the Bulletin of the American Iron and Steel Association, James M. Swank refers to a prophecy made by Abram S. Hewitt. We reproduce the article in question in full:

In a paper which we had the honor to prepare for the United States Geological Survey last year on "The American and Foreign Iron Trades in 1897," the world's production of pig iron at three widely separated periods in the last half of the present century was statistically given as follows:

On February 21, 1856, the Hon. Abram S. Hewitt, then plain Mr. Hewitt, read a paper before the American Geographical and Statistical Society, at New York, "On the Statistics and Geography of the Production of Iron," in which, for the first time, so far as we are informed, an attempt was made to ascertain the world's production of pig iron. Mr. Hewitt was compelled to estimate the production of several countries, but the total production which he obtained for the world was substantially correct. He found that the total production in 1855, forty-three years ago, was, in round numbers, 7,000,000 gross tons. Great Britain's percentage of the total production approximated 50 per cent., while that of the United States was less than 15 per cent.

Twenty years ago, in a review of the iron and steel exhibits at the Universal Exposition at Paris in 1878, we made an attempt to ascertain the world's production of pig iron in that year, and the figures then collated from the best available sources we subsequently revised and printed in our annual report for 1889. The results then obtained we now reproduce below, including the percentage of production by each country. Gross tons are used for Great Britain and the United States and metric tons for all other countries. Our figures show that the world's production of pig iron just doubled from 1855 to 1878:

Countries.	Tons.	Percentage.
Great Britain	6,381,051	44·74
United States	2,301,215	16·13
Germany and Luxemburg	2,147,641	15·06
France	1,521,274	10·67
Belgium	518,646	3·64
Austria and Hungary	434,250	3·04
Russia	417,239	2·93
Sweden	340,558	2·39
Spain	60,000	0·42
Italy	20,000	0·14
Other countries	120,000	0·84
Total	14,262,174	100·00

It will be seen that Great Britain made 44·74 per cent. of the world's production of pig iron in 1878, and that the United States made 16·13 per cent., Great Britain retaining her leadership of 1855 and almost retaining her large percentage of production in that year, while the percentage of the United states in 1878 was almost the same as in 1855, and a very low percentage it was, Germany and Luxemburg making almost as much pig iron in 1878 as the United States.

We now present a table showing the world's production of pig iron in 1897, or in the most recent year for which statistics are available, compiled in most instances from official data, the unofficial figures approaching absolute accuracy. Tons are used as in the preceding table. The figures show that the world's production of pig iron more than doubled from 1878 to 1897:

Countries.	Year.	Tons.	Percentage.
United States	1897	9,652,680	29·30
Great Britain	1897	8,789,455	26·69
Germany and Luxemburg	1897	6,879,541	20·89
France	1897	2,472,143	7·51
Belgium	1897	1,034,732	3·14
Austria and Hungary	1896	1,217,782	3·70
Russia	1897	1,868,671	5·67
Sweden	1897	538,197	1·63
Spain	1897	297,100	0·90
Italy	1897	8,393	0·03
Canada	1897	53,796	0·16
Other countries	1897	125,000	0·38
Total		32,937,490	100·00

The table shows that in 1897 the United States produced 29·30 per cent. of the world's production of pig iron, while Great Britain's share of the total production of pig iron was 26·69 per cent., the United States having passed since 1878 to the front as a producer of pig iron, Great Britain taking second place in its production. The relative position of the United States in the production of pig iron will be fully maintained in 1898.

Recapitulating the world's production of pig iron at the three periods mentioned above—namely, 1855, 1878, and 1897—we have these results: 1855, 7,000,000 tons; 1878, 14,262,174 tons; 1897, 32,937,490 tons. We will now compare these results with some remarkable predictions made by Mr. Hewitt in his address above referred to.

Looking backward over the world's iron history during the century preceding his address, Mr. Hewitt reached the conclusion that the future production of pig iron might be expected to double once in 20 years, except from 1895 to 1915, with the following results: 1875, 14,000,000 tons; 1895, 28,000,000 tons; 1915, 48,000,000 tons; 1935, 96,000,000 tons; 1955, 192,000,000 tons.

Mr. Hewitt's prediction that the world would make 14,000,000 tons of pig iron in 1875 was practically verified, although our statistics show that it was not until 1878 that the production reached 14,262,174 tons. But it will be remembered that the period from 1875 to 1878 was one of almost complete stagnation in the world's iron and steel industries, so that, if the statistics of the production of pig iron in all countries in 1875 were given, it would be found that the production in that year was very little short of that of 1878. The statistics of the world's three great pig iron producers in 1875 and 1878 we give below to prove the accuracy of this statement, and they are all that it is necessary for us to give: Great Britain, 1875, 6,365,462 tons; 1878, 6,381,051 tons; United States, 1875, 2,023,733 tons; 1878, 2,301,215 tons; Germany and Luxemburg, 1875, 2,029,389 tons; 1878, 2,147,641 tons. These figures show very little progress from 1875 to 1878, so that virtually 14,000,000 tons, Mr. Hewitt's estimate, may be said to have been produced in 1875.

Going back to our Annual Statistical Report for 1896, we find that we then presented a table showing the world's production of pig iron in 1895, one of the years embraced in Mr. Hewitt's horoscope. The production in that year we gave as 28,870,792 tons. Mr. Hewitt's prediction was 28,000,000 tons for that year.

It appears, therefore, that 43 years ago a statistical student of the world's iron industry—at a period, too, when industrial statistics were in their infancy—foretold with remarkable accuracy the world's future production of pig iron down to the present time. That Mr. Hewitt's estimate of pig iron production in the years that are before us is likely to be more than realized is rendered exceedingly probable by the rapid strides that have been made in its production in the last few years, and particularly in 1898.—Iron Age.

THE KAFFA STATION.

THE RAILWAYS OF THE FRENCH SOUDAN.

THE day on which the first locomotive, in running from Kayes to Bafoulabé, showed its triumphal trail of smoke in the African solitudes and shrieked such a cry of victory that the affrighted lions fled to the deepest recesses of the distant forests, the rare companions of so unlooked for a trip must have taken some satisfaction therein. From one mountain to the other had been thrown a metallic bridge of which the superstructure rested upon huge piers at the base of which the elephants raised their trunks and trumpeted in astonishment.

From one people, one passed to another, and the stoppage indicated was at a station constructed according to the latest models, and, perhaps, already inscribed in the last edition of the "Indicateur Chaix" or the "Guide Conti."

It is at the cost of the most insurmountable difficulties of all sorts, from the west to the east of central Africa, that our bold pioneers will have soon pierced this fifth part of the world, like a pear, which it resembles. But do not think that the thing is as easy as the opening of a fine fruit quickly, in order to eat it. The descent of the rivers toward the coast and their natural flow from the center of the land proves that Africa is geographically placed upon the globe like a dish inverted upon a table. Access by water to the interior of Africa is, therefore, nil. As for access to the country bordering upon the ocean, through the rivers running thither, that offers such danger, on account of the numerous rapids, that a long and safe navigation is interdicted. Nothing remained but to lay out routes for railways and to construct them.

The following list of projected and completed railways shows the present status of the question:

1. The English lines projected from Sierra Leone, the Gold Coast, Lagos, Kire, and Egypt.
2. The German lines projected from Damarland and German East Africa.
3. The French lines projected from Konakry, the Ivory Coast, Dahomey, French Congo, Madagascar, and Abyssinia.
4. The French lines constructed from Dakar to Saint Louis, and from Kayes to Bamakou.
5. The Belgian Congo line.
6. The Portuguese line from Saint Paul de Loanda to Ambaca; and
7. The English line from Mombaga to the Victoria Nyanza.

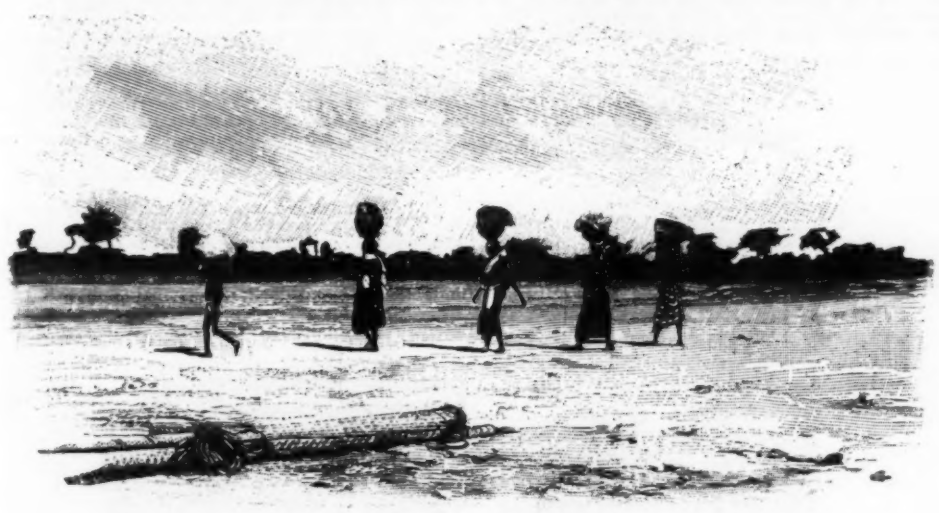
We might mention also the Transsaharian line, which, from Northern Algeria, was to have lost itself in the sand of Central Africa, and which, in fact, was so thoroughly lost therein that it was never found again except in the brain of some lunatic. The only line that common sense could recommend to our countrymen was that which, connecting the Senegal with the Niger, the Congo with the M'bomou and the Oubanghy with the Nile, in a word, the west with the east, through the center, and a line pretty nearly parallel with the equator, would allow of a passage from the waterway to a railway at a great saving in cost. With this medial and principal artery through which

CONSTRUCTING THE PIERS OF THE MAHINA BRIDGE.

all the commercial life would sooner or later pass, would gradually be connected the secondary veins of this well organized body.

The cities would be connected with the villages. Africa would be another and larger Europe, and the capitals of its various royalties or republics would be so many small or large Parises.

But, without looking into the future, let us regard only the present, and through the curtain of this train in motion, before which lions and panthers shrink back in fear, let us witness the inauguration of one of those picturesque lines that our soldiers are



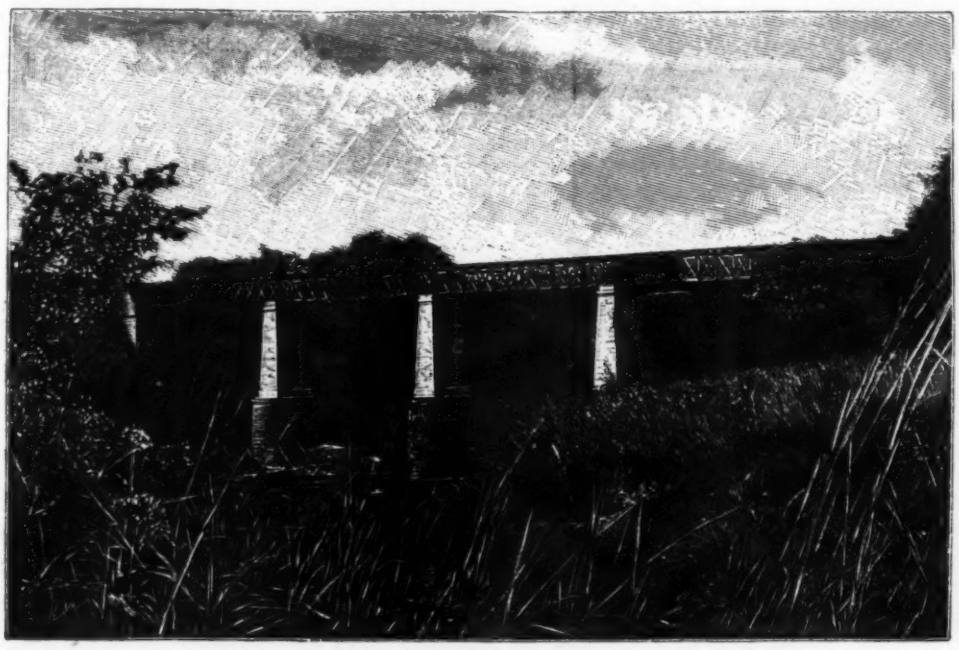
CARRIAGE OF MATERIALS.

constructing from Kayes to Banamako, in singing couplets from La Scala and L'Eldorado.

"We left Diamou at 2 o'clock in the afternoon," writes one of them. "Our locomotive, which had just arrived from France, was trying for the first time the track that had been laid for an engine of much smaller tonnage, so it became necessary to stop every little while to remove the branches of trees and the stones, and shove back the telegraph line that interfered with our progress. At the forty-sixth mile the car in which I was seated with M. Portier and several other officers suddenly raised with a jump that produced a most disagreeable effect.

"We were shaken as if by an earthquake. All the objects that were in the car had rolled upon the floor, and we ourselves had not been able to keep our equilibrium. Our car had been derailed and was bumping over the ties. M. Portier was, fortunately, able to stop the locomotive, and this calmed our excitement. But I shall always remember the bad impression that was made upon all of us at this moment.

"At the fifty-first mile, toward 7 o'clock in the evening, we were again stopped, and this time by an accident that might have proved very serious. The Kayes engine had broken down one of the trestles of a small bridge, and the tender was derailed. By a truly miraculous chance, the locomotive had stopped in



GALOUGO BRIDGE.

time. A native perched upon one of the cars was thrown forward, but an examination made by Dr. Laffont showed that he was more frightened than hurt.

"We are now but five miles from the camp of Galougo, and are making our way thither on foot, on a beautiful moonlight evening, in thinking of the events of our trip, and on the improvements that must be made in this section of the railway before trains can run over it in a very regular manner."

For the above particulars and the accompanying illustrations we are indebted to Le Monde Illustré.

BRICK AND CLAY IN THE BIBLE.

By GEORGE GILLEN, Jr., in Brick.

THE first thing found in the Bible in regard to clay and brick is in Genesis II. 7, where God was the first to use dust or clay, and made man, who should have dominion over all, excepting woman. Of course she was made from man, therefore originated from clay also.

Now, if God had found something better than clay to make man of, don't you think He would have done so? He did not want stone, because it would crumble when exposed to air or heat; He did not want iron, because it would rust or warp; He did not want wood, because it would decay; so you see God was right, as He always is, in selecting clay to make that which was to be superior over all others.

I hear many say, "Oh, brick will not do for such large buildings and towers; we must use stone or iron."

Now I want to tell you something about the first and largest tower built in the world, and in order to do so I will continue reading in my wife's Bible. I come to where the world became very wicked, and God destroyed all men except Noah, his wife, and three sons and their wives, which he did 4,400 years ago. After the flood they journeyed from the east and found a plain in the land of Shinar; they dwelt there, and we find these words in Genesis XI. 3, 4: "They said, one to another, Go to, let us make brick and burn them thoroughly. And they had brick for stone, and slime had they for mortar. And they said, Go to, let us build us a city and a tower whose top may reach unto heaven; and let us make us a name, lest we be scattered abroad upon the face of the whole earth." They went to work and built a tower 272 feet each way at the base, and had reached a height of 660 feet, when God, not wanting them all to remain at the same place, destroyed it, so they would scatter and inhabit the whole earth as He wanted them to do. Had it not been for God's power, that tower could never have been destroyed.

The ancient tower of Babel is now a mound of oblong form. On the western side it rises in a conical form to the elevation of 198 feet, and on its summit is a solid pile of brick 37 feet high and 28 feet wide. The fire-burned brick have inscriptions on them, and so excellent is the cement or mortar on them that it is almost impossible to extract one from the other. This is the first pile of brick I can find exposed to air, still solid and in good condition. Right here I will say, I do not say who made the first brick ever made, or who taught the sons of Noah to make and burn brick. I will leave that for some other brickmaker to do. I expect to refer to walls and ruins that can be seen at the present day and age.

Since I have gone over the history of brick and studied the matter carefully I have decided that if any man will come to me and ask me to guarantee my brick to last 4,000 years or more, if he will use them, I will not hesitate one moment, but go to work on them and make all the brick he can use, provided he will pay me in advance, so I will be able to make them good and hard so I will know they will last 4,000 years or more. I hope, by the time I get through with my subject, all other brickmakers who read this will be willing to do just as I would. I read on and find in Exodus that Pharaoh was making brick; and I think from what we learn, Pharaoh had more brick made than any brickmaker who ever lived or will live. We find he had a great many slaves, and at that time nearly all buildings were erected of brick made of clay and straw, and dried, very few being burned, as the climate and clay were such that it was not necessary to burn the brick. We find the demand for brick was very great, and Pharaoh, seeing the enormous profits to be derived from the manufacture of brick, at once cut on prices and drove all competitors out of the trade. Here I find a problem I never could solve before, why so many brickmakers are so selfish and want to make all brick used themselves, and in order to do so will cut on prices and try to drive their competitors out. You can see by this they are not to blame, for the trick is inherited from their great ancestor, Pharaoh, who was a descendant of Ham; so whenever you see one of these selfish brickmakers you can tell at once he is a descendant of Pharaoh, while all the good brickmakers are descendants of Shem and Japhet. I am very glad my ancestors were white. Now, brother brickmakers, watch out and don't be caught with Pharaoh's gang again. You can see at once that, through Adam, all men have sinned in the past 6,000 years, and, through Pharaoh, all his descendants in the brick business have made fools of themselves in the past 4,000 years. As I have now given you the history of Pharaoh and his descendants, I will return to the walls again.

I find that Babylon was first built by Noah's sons, and destroyed several times, but 570 B. C., or 2,570 years ago, it was the most beautiful city in the world. It was 60 miles in compass, it was built in a square, 15 miles on each side, with a brick wall 87 feet thick, 350 feet high, on which were 250 towers. The top of the wall was wide enough to allow six chariots to drive abreast. Burned brick was used in erecting this wall. Next come the famous hanging gardens in the same city; they were 400 feet square and were raised 350 feet high, one terrace above the other; were supported by large vaultings resting on pillars that were hollow and filled with earth to allow trees of the largest size to be planted, the whole being built of burned brick and asphalt, and had the appearance, from a distance, of woods and overhanging mountains. These walls and the gardens stood about 200 years, until they were destroyed by Cyrus, King of Persia, after a siege of two years. A great many of the brick were glazed and enameled, rendering them equally ornamental for the exterior and interior. Most of the brick bear the name inscribed in cuneiform characters of Nebuchadnezzar, as these walls and gardens were built by him to please his wife, and these walls no doubt replaced those of earlier ages.

Semiramis is said by Diodorus to have overlaid some of her towers with surfaces of enameled brick of elaborate designs. Enameled brick have been found at Nimrod. Pliny says, "the Babylonians used to record their astronomical observations on tile or burned clay." He also, as well as Vitruvius, describes the process of making brick at Rome, and says the Greeks preferred brick walls to stone. A brick pyramid is mentioned by Herodotus as the work of King Asyther. We find upon another pyramid, ten leagues from Cairo, this inscription: "Do not undervalue me with pyramids of stone, for I am better than they, as Jove exceeds the other deities. I am made of brick from clay brought up from the bottom of the lake adhering to poles." Some of the temples of Athens and walls of the city looking toward Mount Hymettus were built of brick. The palaces and temples of Babylon were built upon lofty platforms of brickwork, like those of Nineveh; they are of more than one shape; some are square, others are oblong. Those from Bars Nimrod are generally of a dark red color, while those from the Nugecabe are mostly of light yellow. The name of Babylon is found on monuments of the 18th dynasty, 3,500 years ago.

The great Chinese wall was built of brick on the outside, filled in with stone and dirt. The top is plated over with brick and covered with moss. It is 25 feet wide at the bottom and 15 feet at the top, and from 15 to 30 feet high, 1,500 miles long. The towers are also built of brick. The Chinese empire was about ten years in building the great wall, and employed several million workmen to construct the same. It was built about 2,400 years ago. The wall and towers are still in a good state of preservation in most places.

Much of our most important history of ancient times is found daily among the ruins in Palestine and all through ancient Rome, inscribed on burned brick and tile. The name tile is given to clay burned in squares, and larger than brick, but not so thick. These inscriptions were put upon the brick and tile immediately after they were made, then dried and burned and put away for future reference, sometimes in vaults and walls. Now they are taken out and translated. It is said also that the Egyptians preferred burned clay for books, as we would call them, as floods and fire would never destroy them.

Brick are mentioned in ten different places in the Bible, as follows: Genesis XI. 3; Exodus I. 14, V. 7, 8, 14, 16, 19; Isaiah IX. 10, LXV. 3. Brick kiln is mentioned in three different places, as follows: II. Samuel XII. 9, and Nahum II. 14. I give these references so the reader may do as I did, use his wife's Bible; and perhaps, in hunting up these, see some other passages that will help him.

Many specimens of brick are to be seen in the British Museum with inscriptions indicating their date and purpose. Inclosures of gardens or granaries, sacred circuits encompassing the courts of temples, walls of

fortifications, and towns, dwelling houses and tombs, in short, all but the altars themselves, were of brick. It must be remembered that God always commanded the people to build the altars of stone. We find complaints made by Isaiah, in Isaiah LV. 3, that the people were burning incense upon altars of brick instead of stone. Turning to Exodus XX. 25, the reader will find where the altars were to be built of unhewn stone. The Romans understood perfectly the art of making brick, as will be seen in the baths of Titus and Caracalla. The stone of the Coliseum has not proved so durable. In the ruins of their forts and walls in Great Britain brick of an excellent quality are found, of deep red color, well burned and very hard. The brick made by their successors in England are not particularly noteworthy until about the 14th century. In the time of Henry VIII. and Queen Elizabeth so good an article was produced that it was employed in the construction of many fine edifices.

The Dutch appear to have succeeded better than the English to the skill of the Romans. Their brick have been famous from an early period for soundness and durability; so substantial were they that they served well for floors of houses. Brick were first used for paving in Holland and proved to be very good. Specimens of Holland brick brought over by the early settlers are to be met with in some of the old Dutch houses of New York. In the hilly countries of Nepaul brick are made of such remarkably compact texture and so elegantly ornamented upon their surface as to be particularly fitted for architectural decoration; while the Chinese give to the face of their brick the texture of porcelain.

As said before, it is hard to tell to whom the actual invention of brickmaking is to be ascribed. There is perhaps no place in the world more favorable for the process, none in which the remains of original structures have been more largely used in later times for building purposes than in Babylon; and all history points to the Babylonians as the inventors of brick. Now let us turn to our own country, and we find many buildings in New York, Boston, and Philadelphia, also all over the Eastern States, that have been erected from one to two hundred years, and the walls are still in a good state of preservation; then take the buildings of our Western cities and States, and we shall find the oldest buildings in existence are of brick. Take the brick, stone, and frame buildings, built twenty or even ten years ago, and see which of these buildings are the most substantial and have the best appearance to-day. Now I have given you a very brief history of a few walls of clay and its uses. I could write a book and give the names of hundreds of walls, pieces of tile and pottery made of clay, found in Rome and all through Palestine among its ruins, with inscriptions and in a perfect state of preservation. I could take you to our own Eastern States and show you towers and buildings built many years ago and still in use. I could show you buildings destroyed by fire where the stone crumbled, the iron warped and twisted in all kinds of shapes, while the brick are still the same as when burned.

I have said enough on this subject, and what we want to do now is not to make brick and sit around on store boxes, whittle and growl at each other because we are not selling enough brick to keep us busy and content ourselves with the foundations of buildings which are generally 2 feet high and 9 inches wide; but let us stand by each other in our business and defend it in every way instead of letting the carpenters, lumber men, stone men, and iron men do all the talking, thus convincing builders and architects that their material is the material to be used. Let us get the bricklayer, who is interested in the work as much as we are, to help us and show every man who is about to erect a building that there is no material equal to clay or brick, no matter how large or small the building may be. Let us convince the architect that just as fine buildings may be erected of brick as any other material, although the cost may be a little more at first, but at the end of ten years the cost will be less and the brick building will have a much better appearance than a building built of any other material. No difference how large the building or tower, brick are more substantial and far better than stone for the foundation. In this way we can build up our trade and get to where we should have been one hundred years ago. Study past history, get all the information you can of all great walls built, get ready for any argument that may come up and pour shot and shell into your enemies' camp that is now occupied by the carpenter, stone man, and lumber dealer. Let us as brickmakers and bricklayers all unite and see what can be done, and you will see a great improvement over the old way of doing business; quarreling with each other and letting our competitors do the furnishing with some other material to erect the buildings and doing the work we should be doing.

ELECTRIC TOWING UPON NAVIGABLE WATERWAYS.

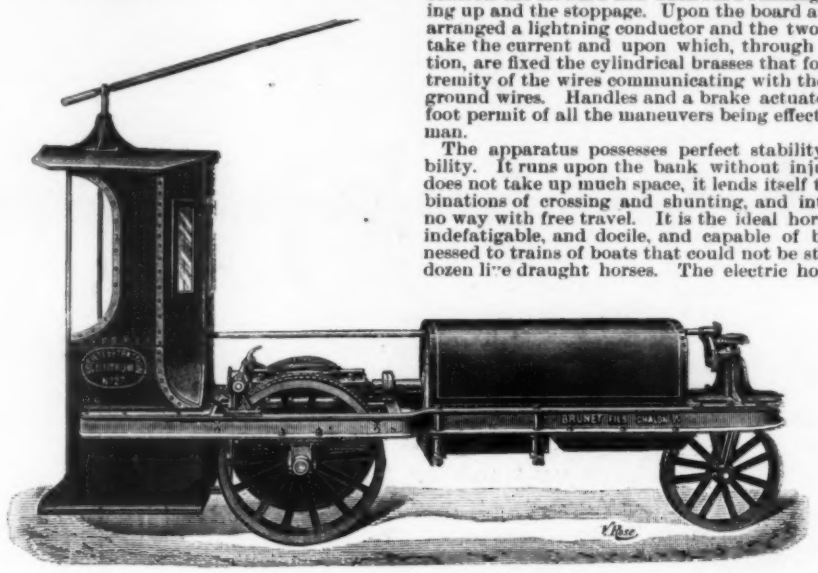
THE problem of towing boats on canals, although seemingly a most simple one, has been far from being solved up to recent years. At an epoch in which machines are everywhere tending to replace animal power, towing by horses has remained in favor upon a number of navigable streams. Moreover, towing by men is still employed in France. Although the use of the horse saves human dignity a trying ordeal, it does not give much more rapid results, inasmuch as towing horses are often wanting at the relays at which they are expected to be found. This occurs so frequently, and so greatly retards transportation, that many boatmen install a genuine stable on their vessels, and carry their horses with them. It is unnecessary to say that such a system is far from being economical.

Mechanical traction has by no means reached an acceptable degree of perfection. Steam tugs, either with side wheels or screws, are costly, and, besides, through the agitation of the water, they rapidly destroy the banks of the canals, which latter are usually narrow. Although their mode of action is a little more rapid, they often lose such advantage when the lock chambers are not large enough to receive them along with the boats that they have in tow; and this is generally the case. It requires as many lockings as there are boats before it is possible to resume the journey, and what a delay this causes may readily be seen.

On another hand, as wheels or screws take their purchase in a mobile medium, they lose a great part of their effect through the recoil, and this renders the operation more onerous than it ought to be.

In order to prevent such loss, chains have been laid upon the beds of canals, and over these the towing is done by tugs. As the bearing point is stationary, there results a true economy; but chain tow boats have all the other inconveniences of the floating ones, and also some that are proper to them.

Other systems also have been tried. A few years ago, towing by endless cables running over pulleys upon the shore was inaugurated. However ingenious this system was, it did not give entire satisfaction. Whatever were the precautions taken, the cables always twisted under the tractive stresses and thus rendered very difficult the attaching of the tow line that connected them with the boat.



THE GALLIOT ELECTRIC LOCOMOTIVE.

In France, an endeavor was made some time ago to solve the difficulty by returning to the origin of things and utilizing the tow path. A railway was constructed upon the latter, and small steam locomotives running thereon replaced the horses of former days. Unfortunately, the establishment of such a road was very costly, and, besides, all tow paths were not adapted for its reception, and many had to be reconstructed.

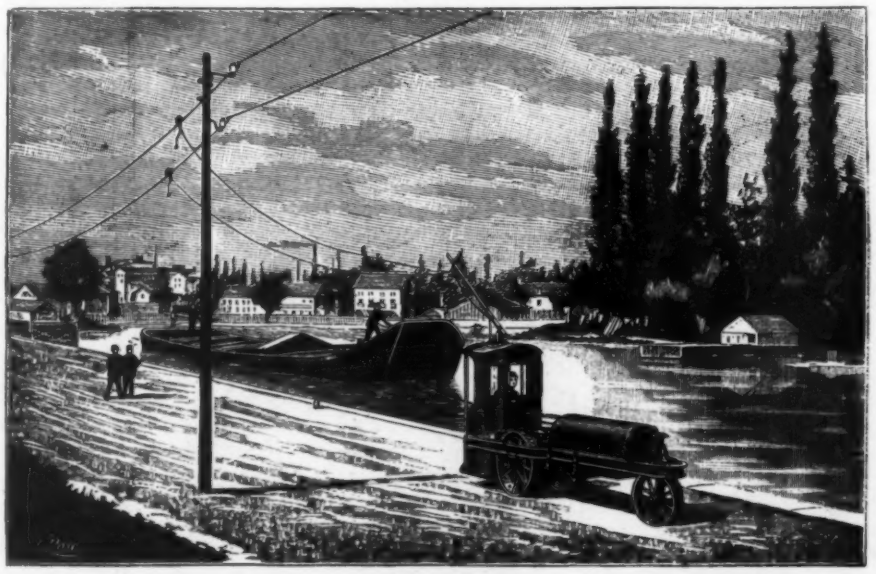
M. Galliot, of Dijon, confining his labors to the order of ideas just indicated, has devised a system which seems to have solved the problem very happily. He makes use of the tow path, but just as it exists, and without transforming it or having to consolidate the banks of the canal. He runs thereon an electric traction engine—a true mechanical horse, which is very light, does not overload the embankment, and runs freely without rails, steered simply by a conductor, whose task is exceedingly easy, since the speed of towing must not exceed two miles an hour. This electric motor receives its current through an overhead trolley. It is a tricycle with wide wheels that finds upon the ground, through its own weight, a sufficient purchase to furnish a powerful tractive stress. The vehicle moves along the bank of the canal through a trolley connected with an aerial line that follows all the sinuosities of the watercourse and leads from the power stations the current that actuates the dynamos. The cable for towing the boats is fastened to the rear between the two driving wheels. In front, the steering wheel, of smaller diameter, is set into the horizontal carriage, which is U-shaped and carries a two-pole receiving dynamo with ring armatures and inductors excited in series, and capable of absorbing without detriment to the apparatus from 4,000 to 6,000 watts.

The dynamo shaft, which runs in the direction of the axis of the carriage, actuates, through a bronze endless screw, a toothed wheel keyed upon the axle of the driving wheels. These latter are of iron, and their fellies are covered externally with cords of aloes fiber that give the whole affair a certain elasticity and increase the adhesion. Back of the wheels, the frame carries a canvas cab designed to shelter the engineman and the running and steering apparatus. The front of the cab is glazed. The driver, who is usually seated, has in front of him and within his reach a hand wheel by means of which he controls the steering wheel through the intermedium of a bevel gearing and a horizontal shaft that extends to the front of the carriage. To the left is the electric distributing board, arranged vertically and comprising a commutator that controls the forward and backward running, the slowing up and the stoppage. Upon the board are likewise arranged a lightning conductor and the two rods that take the current and upon which, through hard friction, are fixed the cylindrical brasses that form the extremity of the wires communicating with the line and ground wires. Handles and a brake actuated by the foot permit of all the maneuvers being effected by one man.

The apparatus possesses perfect stability and mobility. It runs upon the bank without injuring it, it does not take up much space, it lends itself to all combinations of crossing and shunting, and interferes in no way with free travel. It is the ideal horse, strong, indefatigable, and docile, and capable of being harnessed to trains of boats that could not be stirred by a dozen live draught horses. The electric horse, too, is exceedingly manageable, even when it is not employed for towing. Its driving wheels can be thrown out of gear, and it can be moved to any roadway by any sort of means whatever. If it be desired to make it evolute in situ, its steering wheel is turned at right angles, and one man can, in an instant, cause it to effect a half revolution.

The line that receives the trolleys is carried by poles erected alongside of the tow path. As the return of the current cannot be effected through rails, as upon tramway lines, it has been necessary to establish it double. One of the conductors is the line wire that leads the electricity to the motor of the engine, and is held by insulating supports. The other, the return conductor or ground wire, is simply carried by iron brackets, and communicates with the earth at about every 250 feet.

The line wire, the only one that might offer any danger (on account of the high potential of the electricity that it leads) is placed sufficiently high to be out of reach of imprudent hands. When it is lowered for passing under bridges, it lodges in a rectangular piece of wood underneath which there is a longitudinal channel for the passage of the wires of the trolleys.



CANAL BOAT TOWED BY THE ELECTRIC LOCOMOTIVE.

The latter, which are naturally two in number, are small bronze carriages carried upon the wires by grooved pulleys. A counterpoise beneath causes them to preserve a nearly vertical position. A metallic brush puts them in perfect electric contact with the conductor, and flexible wires connect them with the conductors of the engine, which are carried at some height by a slender rod and bracket. A very simple system permits of connecting them with or separating them from the conductors. This arrangement renders crossings very easy. When two electric horses meet each other, it suffices for them to change trolleys in order to continue on their way.

The works that produce the electricity are in close

proximity. This permits of reducing the cost of establishment of the line without elevating the potential beyond measure. They should be installed at a distance of seven or eight miles apart, and, in order that the service may always be assured, each should possess four 50 horse power engines, three of which should be run at the same time.

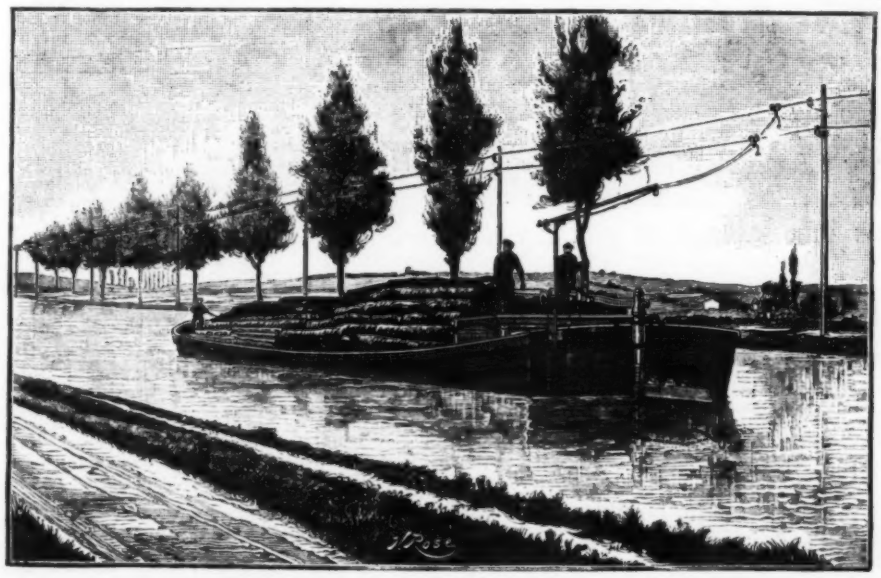
Experiments with the Galliot system were first made at Paris, and then upon the Bourgogne Canal for a distance of two and a half miles. These were crowned with so complete a success that the most competent judges have asserted that the problem of towing upon canals seems now to be solved to the great advantage of internal navigation and consequently of the commerce of the country.

To prepare an excellent innovation, to study it in all its details, and to solve every difficulty is a very fine

THE GALLIOT PROPELLING RUDDER.

thing, but the inventor has then accomplished but half a task of which the other half is often very difficult. We refer to the trouble of getting the system adopted. M. Galliot and his associates, after organizing the Société de Traction Electrique sur les Voies Navigables, had to busy themselves with the work of finding customers. The north of France, which is so rich in canals upon which there is an immense traffic, was plainly indicated. The chambers of commerce of the region were confronted with the question; but, despite the decisive experiments already made, they wished for more light and something more precise, and asked for a report from Prof. Aimé Witz, of Lille. This report, which touches upon both the technical and commercial questions of the enterprise, especially from the viewpoint of the waterways on which the establishment of the system was proposed, seemed most favorable to the chambers, and work was then begun.

As the first project was to establish electric towing upon the canals comprised between Bethune and Bassin Rond, near Cambrai, for a distance of fifty miles (canals of Aire, Deule, Derivation de la Scarpe, and Sensée), the work was begun upon a section of fifteen miles, from Bethune to Verdun. Two works for supplying this entire line were built, one at Gorre, near Beurry, and the other at Bauvin. The exploitation was begun in September last, and in that month alone



CANAL BOAT PROPELLED BY MEANS OF THE GALLIOT RUDDER.

the company had 107,000 tons to tow. Owing to such success, the towing was granted to it upon the entire line projected; and the second section, which will comprise four electric works, is about to be constructed.

In addition to the traction engine, the special object of which is to tow trains of boats, M. Galliot has prepared, and his company is exploiting, a propelling rudder, which is applicable to isolated boats. This device, which is substituted for the ordinary rudder, consists of a narrow, hermetically closed box of iron plate, which tapers at the back in order to allow the water to have easy access to the screw. This latter, in fact, contrary to the arrangement in use upon ordinary boats, is inclosed in the rudder itself and actuated by a dynamo inclosed in the iron plate box. Four wires that admit the current make their exit from the top of the box and serve to control, from the helm, the motion of the screw. This latter, which is of bronze, has three blades, and, in a normal run, makes 300 revolutions a minute. The adaptation of this apparatus is always easy, and its substitution for the ordinary rudder requires but a few minutes.

The rod and bracket of the towing engine is here replaced by a mast four feet in height, at the top of which the trolley cables connect with the conductors of the boat's engine. For this kind of utilization of the electricity of the line, the cables are long enough to cross, without fouling it, every boat met with on the trip.

In conclusion, it may be stated that at present Messrs. Thwaite and Cowley are recommending in England a system which has a few points of resemblance with that of M. Galliot, but which is very far from being characterized by its simplicity.

For the above particulars and the engravings we are indebted to Cosmos.

OUR TRADE WITH JAPAN.

THE steady and rapid growth of our commerce with the Orient is illustrated by a statement just received by the Treasury Bureau of Statistics, showing the imports and exports of Japan, during the first half of the last calendar year. This shows that Japan's purchases from the United States continue to increase with great rapidity, while in many cases those which she has been accustomed to make from other parts of the world are being reduced. Her importations of raw cotton from the United States in the first six months of 1898 were 12,732,064 yen in value, against 3,811,828 yen in the corresponding months of the preceding year, the quantity being given in the six months of 1898 at 659,716 piculs, against 184,025 piculs in the corresponding months of 1897, the picul being equivalent to 133 pounds. On the other hand, the importation of cotton from British India, whence most of the cotton for Japan had formerly been drawn, fell from 791,621 piculs to 697,047. The total importations of cotton into Japan in the half year amounted to 27,702,963 yen in value, an increase of a little over 4,000 million yen over the corresponding months of 1897; while the increase from the United States alone was nearly 9,000,000 yen, showing a general reduction from other parts of the world, while the imports from the United States were more than trebled.

Our manufactures of iron and steel seem to be especially satisfactory to the Japanese, the increase in nearly all articles of this class being strongly marked. Imports of locomotive engines from the United States increased from 824,080 yen in the first half of 1897 to 1,443,240 yen in the first half of last year. Of nails, the imports into Japan from the United States increased from 3,260,858 catties in the first half of 1897, to 7,494,197 catties in the first half of the last year, the catty being $1\frac{1}{3}$ pounds, the total importations of nails having fallen meantime from 10,394,717 catties in the first half of 1897 to 8,754,035 in the first half of the past year. The imports of "bar and rod iron" from the United States increased from 168,085 catties in the first half of 1897 to 1,071,430 in the first half of 1898; while under the head of "other iron and steel" the imports from the United States increased from 9,410 yen in the first half of 1897 to 197,475 in the first half of 1898, the value of the gold yen being 49·8 cents.

Importations of alcohol from the United States increased from 10,283 yen in value to 165,254; those of cigarettes, from 284,091 yen to 351,570; of beans and pease, from 414 yen to 16,566, while other articles of this class also showed marked increase.

The finer grades of American manufacture also seem to be finding special favor among the Japanese, imports of American watches having increased from 95,511 yen in the first half of 1897 to 165,690 yen in the first half of the past year, while our own records of exportations show an increase in exports of typewriters, sewing machines, and other articles of this class to Japan in the fiscal year just ended as compared with those of the preceding year.

Returning to our own statements of exports to Japan, it is found that in the first seven months of 1898 our exports to Japan increased over 57 per cent, as compared with the corresponding months of 1897. This increase was in a large number of articles, such as books, maps, and engravings, wheat flour, cycles, clocks and watches, raw cotton, hides and skins, instruments and apparatus for scientific purposes, including telegraph and telephone, steel rails, sewing machines, sole leather, kerosene oil, paraffine, butter, cheese, and many other articles.

OUR TRADE WITH CHINA.

AMERICAN imports into China continue to increase, while those of other countries decrease. This is shown by the statement of the Chinese trade reports for 1897, just received by the Treasury Bureau of Statistics. The document in question is a large volume of nearly 1,000 pages, and contains reports from the customs officials of all the ports of China, and also a general statement from the statistical secretary of the Chinese customs service, Mr. F. F. Taylor, who calls attention to the general falling off in importations of cotton goods by reason of the erection of local cotton mills, but says, "American goods, however, continue to increase in favor, drills showing an improvement of over 300,000 pieces, jeans of over 15,000 pieces, and sheetings of nearly 170,000 pieces—but these are almost the only exceptions to the general decline. Drills, except American, show a heavy decrease, while jeans improved. Of sheetings, except American, less were imported by over half a million pieces."

Mr. Taylor's statement, however, contains a warning to American exporters of kerosene oil, that their trade in China is being endangered by Russian and Sumatran oils, saying: "American oil is finding vigorous rivals in Russian and especially Sumatran oil. In 1894 the figures of importation were: American, 51,570,853 gallons; Russian, 17,500,283 gallons; Sumatran, 534,280 gallons; while in 1897 they were: American, 48,212,505 gallons; Russian, 36,924,125 gallons; and Sumatran, 14,212,278 gallons."

The reports of the commissioners of customs at the various ports also contain many statements of interest to American manufacturers. Commissioner Lay, of Newchwang, says on the question of the growth of American trade in cotton cloths: "The rapidity with which English drills have been disappearing may be seen by noting that the importation only four years ago amounted to 80,000 pieces, while during the period under review (1897) only 3,000 pieces arrived. The predominant position secured by American drills and sheetings referred to in past reports is now one of sheer supremacy. The most striking feature in the category of sundries is the overwhelming importation of kerosene oil, in which trade the supremacy of the American brands is exceedingly pronounced, for the large importation of 526,000 gallons in 1896 has been eclipsed by the 2,041,000 gallons to the credit of the period under review."

Commissioner Hippisley, of Tientsin, in his report says: "The notable increases in importation are 60,000 pieces in jeans and twills, 107,000 pieces in American drills, and 175,000 pieces in American sheetings. American kerosene has risen from 2,743,200 gallons to 4,560,500 gallons; Russian from 3,246,000 gallons to 5,208,380 gallons, and Langkat from 25,000 gallons to 120,000 gallons." Discussing the railway developments of that section of China, he says: "It is astonishing how speedily Chinese, despite their reputed conservatism, adapt themselves to a new environment and make the most of increased transport facilities offered them. Already Peking fruit is sent direct to Tangku for shipment south and Peking is similarly supplied with southern fruit; and traffic generally developed so rapidly that it soon became necessary to double the line."

Commissioner Carrall, of Chefoo, says: "In cotton goods the most notable increases in importations come under shirtings of all kinds, 17,661 pieces; American drills, 36,704 pieces; and Japanese yarn, while decreases are shown in English and Indian drills and sheetings, handkerchiefs, and towels. Five million two hundred and eighty-one thousand and sixty gallons of American kerosene oil were imported during the year, against 2,388,250 gallons in 1896, while arrivals of Russian kerosene (577,800 gallons) more than doubled the record of the previous year." Commenting on the exports of silk goods, the commissioner adds: "The United States markets are now practically closed on account of the prohibitive import duty levied, as much as 700 per cent. in some instances."

Commissioner Hughes, of Wuhu, says: "Of foreign sundries the most important is kerosene oil, the increase in the importation of which is something phenomenal, having risen from something over half a million gallons ten years ago to over two and a half millions in the year under review. The American variety still holds its supremacy."

Commissioner Rocher, of Shanghai, in his report says: "In cotton goods, with the exception of Indian T-cloths, American drills, English jeans, American sheetings, cotton lastings and Japanese cotton cloth, all of which show a substantial increase, there was a downward tendency. Shirtings and drills from the United States and Canada largely outnumbered those of the English make, for the reason, it is alleged, that freight from America was much lower than from England. Re-exports of cotton goods improved 6 per cent., American makes counting for a good half of the appreciation. A considerable expansion of the kerosene oil trade is to be noted. Though American oil retains its premier position, both Russia and Sumatra have taken their fair share of the increase. The proximity of Sumatra to the China market gives the Langkat product an advantage which has been fully availed of and followed up by the establishment of bonded tanks at Pootung."

Commissioner Von Mollendorff, of Ningpo, says: "Kerosene oil advanced 480,555 gallons, chiefly in American produce." Commenting on the cotton trade, he says: "The native cotton mill established at this port has an addition of 6,000 spindles, and the mill is run day and night without interruption."

Commissioner Morehouse, of Amoy, remarks that owing to an unusually good grain crop it was unneces-

sary to import American flour, rice, or wheat to the extent of former years, and adds: "T-cloths arrived to the extent of 62,038 pieces, an increase over 1896 of 10,617 pieces. American drills and chintzes exhibit increased figures; 1,252 pieces of the former and 4,038 pieces of the latter are noted. Kerosene oil figures are the highest in the history of the port—3,830,920 gallons arrived. The American production stands at the head, 1,728,690 gallons, followed by Russia, 803,770 gallons, while Sumatra amounts to 714,400 gallons. The trade in American flour fell off considerably, as the large rice crop obviated the necessity of purchasing foreign flour."

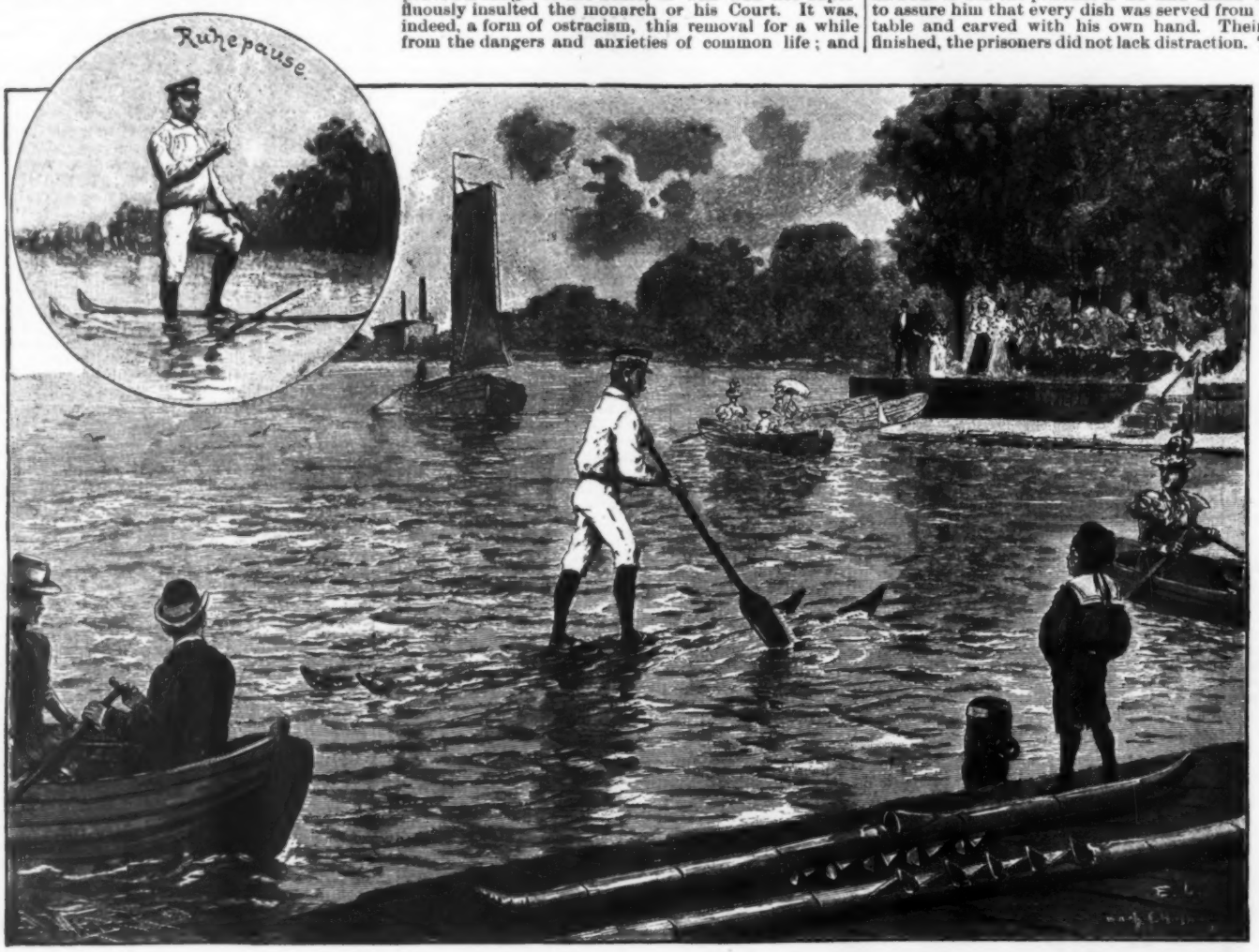
Commissioner Piry, of Lappa, calls attention to the decrease in importation of European cotton goods in contrast with the reports of increased importation of American cotton goods, and commenting on the rivalry of Sumatran oil with that from the United States, says, that while imports of American oil rose from 208,270 gallons to 355,595 gallons, Sumatran oil increased from 68,675 gallons to 104,470 gallons, and adds: "Sumatra oil continues to be in great demand, and now, the third year of a steady advance, can be said to have taken a firm hold on the market."

METHOD OF WALKING ON WATER.

DURING the spring and summer of last year, a man could sometimes be seen on the Saale, near Halle, endeavoring to walk through the water on huge shoes. The "water-walker," as he was called, was Otto Grossmann, a man who had often been rewarded for his bravery in saving people from drowning. Grossmann first endeavored to walk on the Saale toward the middle of last July. Much to the astonishment of the many people who lined the shores of the river, he moved about in the water, stopped and started again, with the utmost facility. The manner in which the water-walker apparently disregarded the nature of the element in which he traveled must certainly have been perplexing. Soon after his first attempts at water-walking on the Salle, Grossmann disappeared, but reappeared in Berlin during October, and attracted no little attention by taking a Sunday promenade on the river Spree. He had actually walked upon the water from his native town to the capital.

Grossmann's watershoes consist of two air-tight zinc cylinders, 4 meters long and 5 centimeters in diameter. On the underside of these cylinders are pivoted five square flaps. When one cylinder moves through the water, the flaps move rearwardly and then lie flat against the shoe; the flaps on the other shoe, which at the time is stationary, are in a vertical position and hence offer a certain resistance. The water-walker glides along much after the fashion of a skater, with the difference, however, that while one foot is moving forward, the other moves rearwardly to a slight degree. The feet are secured in the upper part of the shoe by means of straps. When in motion the water-walker uses a short oar to assist him in his movements.

With this simple apparatus Grossmann glides along rapidly, and apparently in perfect security. He is disturbed not even by the waves produced by passing steamboats. It is an odd spectacle to see the water-walker stop and rest. At such times, he merely sinks one foot deeper in the water than the other, and in this position discards his oar, and eats, drinks or smokes.—Illustrirte Zeitung.



WALKING ON THE WATERS OF THE RIVER SPREE.

HOW PRISONERS LIVED IN THE BASTILLE.

AN enforced stay in the most splendid palace would prove an infliction to any free-born, ambitious child of man; compulsory well-being jars as acutely upon our senses as helpless misery. To be here to-day and gone to-morrow is for the adventurous the true secret of happiness, and a genuine suffering is inflicted by the assurance that you could not, if you would, leave a comfortable library for the doubtful pleasure of the town. There was, then, a definite hardship imposed upon those who sojourned in the Bastille—a restricted movement, an ominous certainty of inaction, for which not even the best society and the oldest wine could wholly atone. But apart from the necessary restriction, a stay in the famous prison of Paris was little more than an agreeable diversion. It seemed, indeed, as though the King were on his mettle. His greatest anxiety was for the comfort of "my prisoners," as he curiously styles them. Again and again you will find notes, signed by the royal hand, insisting that the tastes of the gentlemen whose liberty was for a while curtailed should be gratified without stint or complaint. In the first place, not everyone was free of the Bastille. The crimes punished by imprisonment in this august dungeon were not, in the golden age at least, the common crimes of robbery and murder. No man was deserving a lettre de cachet who had not proved a danger to the State, or who had not superfluously insulted the monarch or his Court. It was, indeed, a form of ostracism, this removal for a while from the dangers and anxieties of common life; and servant, he was disturbed by the drawing of bolts and the turning of keys. Two jailers, silent and discreet, entered to serve the dinner. The plates were but of common crockery, and the linen, though white, was coarse and rough; nor was the cutlery such as became an eminent man of letters. The food, however, was excellent, though it was Friday and meat was piously withheld. A soup of white beans, with the freshest butter, was followed by a dish of the same beans perfectly cooked. Then came a codfish exquisitely seasoned with garlic, so fine in taste and odor, says the captive, that it would have flattered the palate of the greediest Gascon. The wine was not of the best, but it was passable, and the absence of dessert seemed the one and only fault; at any rate, Marmontel seemed in good spirits, and reflected that, after all, prison fare was not despicable. But no sooner was the repast finished, than again the bolts were drawn, and the jailers entered again, this time carring a pyramid of plates. At the sight of the fine porcelain, the delicate linen, the silver knives and forks, Marmontel recognized his mistake. He had eaten his lackey's dinner, and there was nothing to be done but for the lackey to take his revenge upon what was prepared for his master. And it was a feast that might be served at a London club or at the high table of a learned foundation. This time there was no thought of Friday. An excellent soup, a succulent slice of beef, the thigh of a boiled capon, fried artichokes and spinach, a fine pear, fresh grapes, a bottle of old Burgundy, and the finest Mocha! And to cap all, the governor called within an hour to ask the prisoner if he had dined well, and to assure him that every dish was served from his own table and carved with his own hand. Their dinner finished, the prisoners did not lack distraction. They exchanged visits, and received their friends; they played cards or devoted themselves to the translation of the classics. One captive desired a violin; it was given him instantly. Another was an amateur of the flute, and he was permitted at reasonable hours to gratify his taste. The library was large and well chosen; no gentleman who professed an interest in sciences was disappointed, and the collection of novels was celebrated. Moreover, an amiable censorship was exercised by the lieutenant of police, and we hear that a poem upon the Greatness of God was struck out of the catalogue, on the ground that it might prove too melancholy for the prisoners. Nor was the governor more careless of his captives' wardrobes. Fine linen for the summer and furs for the winter were generously supplied, and no trouble was spared to suit the fancy of the wearer. There was one lady, for example, who demanded a dress of white silk sprinkled with green flowers; and the wife of a commissaire spent several days in ransacking the shops of Paris. The stuff, unfortunately, was not to be found. The nearest approach was a white silk with green stripes, and if that suited the lady, her measure should instantly be taken.—Charles Whibley, in Macmillan's Magazine.

SCOTCH OPINION OF UNITED STATES GOODS.

IN this market, American manufactures, with few exceptions, are regarded as above the average in point of quality. To be more specific, the articles of American make sold here, either to a large or limited extent, have gained acceptance on account of quality rather than on account of comparative cheapness; they are better for the money than like articles produced here or on the

Continent. It is distinctly true, therefore, to say that our products have obtained favor in Scotland and are gaining favor on their merits. Wherever one goes in this country he finds the opinion prevailing that American manufactures and other products are up to the best standard. Generally speaking, it is considered in Scotch communities that to say an article is American is to commend it. The exceptions are not yet conspicuous and are confined to certain grades of bicycles thrown on the market a year or two ago, which tended to damage the American bicycle trade here.

Our manufacturers and other producers may well be proud of their reputation on this side. In food products and in general lines of wares, there are few dealers who do not comment upon the high standard of the articles they receive from the United States. For example, a wholesale grocer who has handled American tomato catsup, chili sauce, and similar goods for many years, when recently at this consulate to make the necessary declaration for returning a small quantity—about $100 in value—remarked:

"A portion of the last shipment was damaged in some way. This is the first time I have ever sent back any American goods. They have been uniformly first class. These articles made in the United States are better than the French and are much preferred by the public."

A dealer in machinery informs me that he has never yet had reason to complain of a failure on the part of an American manufacturing company to properly fill a definite order for an article which was in their line of production. His only criticism is that now and then a firm or company which does not make the article wanted will either send or propose to send something else "to see if it will serve." That, he says, is always a blunder.

In the interest of American trade in Scotland, it is a matter of the utmost importance that our manufacturers maintain the reputation they have earned for high quality of material and workmanship. Perhaps there is no other market where good quality counts for more than it does here. It is the essential thing, and, if united with a moderate price, it secures trade. Finish may be quite important, but the chances are that a bad article well finished will have a scant sale and soon drop out. To gain a profitable trade in this country, and to hold it, a manufacturer must offer an article of solid merit and keep it up to the original standard. Finish, and what is rather indefinitely termed "style," and anything else designed to render wares attractive, are of permanent use only in helping the sale of an excellent article. I doubt if any American manufacturer would profit in Scotland by lowering the grade of his product to meet competition in the price. On the other hand, if he keeps up the grade, his rival, whether English or Continental, who resorted to the "cheap and nasty" tactics would be the loser in the end.

RUFUS FLEMING, Consul.

Edinburgh, December 15, 1898.

The new naval dry dock soon to be built by the government at Boston, Mass., will have the following dimensions, according to a published interview with officials of the Navy Department: Length, 750 feet; width on floor, 80 feet; width at top, 114 feet; width at entrance, 95 feet; depth to floor, 40 feet; depth on sill, 30 feet. It will be built of granite or concrete faced with granite. The steel caisson gate will be about 95 feet long, 36 feet deep and 24 feet beam. The pumping plant will include three 45 inch centrifugal pumps. If built entirely of granite, about 576,000 cubic feet of cut stone and 1,390,000 cubic feet of rubble masonry will be required; if concrete faced with granite, the quantities would be about 256,000 cubic feet cut granite and 1,710,000 cubic feet of concrete.

ANOTHER NEW FRUIT.

To our distinguished friend, M. Ed. André, the editor of the Revue Horticole, we are indebted for

FRUIT OF FEIJOA SELLOWIANA—YELLOWISH-GREEN, RICHLY PERFUMED.

specimens showing the foliage of this tree, and for the opportunity of tasting the fruit. The Feijoa Sellowiana is a south Brazilian myrtaceous plant, with thick, leathery foliage, covered with fawn-colored down on the under surface. What the flowers and fruit are like may be judged from our illustrations; but to attempt to convey any description of the flavor of the fruit in words would be futile. Suffice it to say that it is—well, it is "fruity," acid, aromatic, spicy—we will add only one more adjective—delicious.

The plant was introduced by M. André himself from Uruguay, and the specimens sent to us were ripened in his garden on the sunny shores of Golfe Juan. The residents of that enchanting district therefore have, thanks to M. André, another attraction to the many they had before. In this country a warm greenhouse treatment would suffice, and the method of cultivation required for Eugenia Ugni would probably be quite suitable in this case. The petals are hooded, fawn-colored externally, purplish crimson within. It would be a valuable introduction into most of our subtropical or warm temperate colonies, and will, we trust, secure a more lasting appreciation on the part of the public than has been the case with the Eugenia Ugni. Unlike other myrtaceous plants, the stamens are straight, and not coiled up or twisted in the bud.—We are indebted to The Gardeners' Chronicle for engravings and article.

ANOTHER NEW FRUIT—FEIJOA SELLOWIANA—FLOWERING SHOOT.

THE ETHICS OF PRIMITIVE PEOPLES.*

WE really know nothing about the truly primitive man; but we call any savage, any barbarous tribe or nation, who is at present, or who has been known to history to have been, in the lowest condition of culture, "primitive." We understand by primitive peoples, savages, barbarians, unlettered races, living in the hunting and fishing condition of human life (as low as any we can think of); and I shall examine the question whether they have an ethical instinct and whether they obey it.

The psychological basis of ethics is to do that which we feel we ought to do. It is the carrying out, in life and action, of the sense of duty which we feel within us. Kant, that great master of metaphysical philosophy, in his wonderful treatise on ethics, practically acknowledges that, psychologically or metaphysically, the sense of duty—the "I ought"—is something incapable of further analysis; that we strike, as it were, bed rock, when we come to that; and on that supposition he bases his only argument for the belief in a God.

Nevertheless, modern writers, leaving the field of metaphysics and going into that of ethnology, have come to a definite, clearer opinion. They have not given up as insoluble the deep and mysterious problem why we feel that we should do an action and should not do another one; they look upon it as being an expression (worked into our minds through limitless ages, in a number of generations of ancestors) of the sense of survival. The basis of ethics, in the modern philosophy of ethnology, is, simply, that we do that, and we feel that we ought to do that, which contributes most to our preservation and progress. There is no other basis which the modern philosophy acknowledges for ethics than that; it is the effort to survive in the struggle for existence, "to continue always that which we are, with such improvements as will prevent failure."

When we speak of an ethical action, we mean one which psychologically arises from the sense of duty. Rid the mind of all else than that psychological aspect, and we have a clear field; we will not say that this or that action is good or bad in itself, but shall always ask for the motive. Is that motive one which arises from the sense of duty, the best enlightened duty which that man or woman knows of at the time and place? Not what she will know to-morrow—no, indeed. If we could all look into to-morrow, we should change our actions to-day very materially, and to great advantage, but we cannot; therefore, I shall examine the psychology of primitive peoples from the pure element of duty: Do they act according to a sense of duty, and have they a sense of duty? Have they what the Germans call "Das Sollen" ("the should") in their hearts? If they have, do they obey it? If they do, why should we not concede to them an ethical nature? Who of us cannot look back in his history and see that over and over again we have done that which was other than our duty, but did not know it at the time. What sect of religion is there that has not stains upon its history arising out of their very devotion to the sense of duty? Need I refer to the horrors of Torquemada's Inquisition, which has been a blot on the history of Christianity, far greater, more heathenish and horrid, than any of the persecutions of heathen Rome?

There are certain predispositions of mind—certain errors of judgment—we are all apt to fall into in examining primitive people—savages, Indians, negroes, barbarians. The principal errors of judgment are four. First, the judgment of action instead of motive. In the missionaries' accounts of the savages or pagans whom they go to convert to Christianity, the emotions are appealed to by a description of the terrible actions they commit. They hurl innocent people under the car of Juggernaut to be crushed by its wheels; they burn slaves and wives in a holocaust that consumes the chief's body; they murder their children and destroy their parents; they eat each other and their enemies; many other things terrible to listen to, apt to soften the heart and loosen the purse strings, yet motive is ignored, and it is the motive only that should concern us in examining the question of ethics

Another error—never judge the savage or primitive tribe which has been in contact with the blessings of civilization and Christianity. Those blessings invariably lead to degeneration in the savage nature. There are sound ethnological reasons for this. I cannot assert that it is civilization, precisely, nor Christianity, precisely, that invariably leads to this degeneration; whether it is the gin of the trader or the entire subversion of ancient principles, rooted in the mind by the new doctrines; but the degeneration is everywhere recognized, known, and visible. The primitive man must be examined as he is before those inestimable blessings are presented to him.

Third is the "dualism of ethics," important because more visible in savage than in civilized life. Ethnology bases all ethics on the idea of self-preservation as its final analysis. Self-preservation requires far more strenuous and desperate endeavor in savage conditions than in our own. The Australian blacks, or the Fuegian Indians, are small bands roving over a certainly sterile country, barely obtaining enough food and knowing that the moment they meet another band the result is a hand-to-hand combat. They therefore feel that they owe to themselves everything which is possible to sustain and preserve life and the integrity of the tribe, gens or clan; but that very instinct makes them feel, also, that they owe to the tribe the destruction of the enemy; and they have one code of morals (which we would call very ethical) for themselves and another code of morals (very unethical) for the others. All that we sum up under the general name of war; all the violations of every principle of humanity, truth, and respect for life and property which we carry out in war to-day, without the slightest hesitation, they do in a more naïve, open, simple, and rude manner; but we have no reason to cast any stain upon them on this account, as compared with ourselves. So long as the necessity for tribal or national existence remains through war, all these elements of war must forever remain the same. War cannot be carried on without slaughter, destruction, deceit, falsehood, and every

* A lecture delivered before the Society for Ethical Culture, of Philadelphia, by Dr. Daniel G. Brinton, of the University of Pennsylvania. Specially prepared for the SCIENTIFIC AMERICAN SUPPLEMENT.

other in itself unethical, unsocial action. Remember, therefore, the "dualism of ethics."

The fourth error, often committed, is not understanding the condition of the primitive man's conscience, which is not individual (as ours generally is supposed to be) but social—communal. He has the conscience of his tribe, of his family, of his clan. He does not feel when he is injured that his individuality is attacked (that is not the sensitive point with him), but his clan, his family, is attacked through him; he is only the medium of the attack. So, when he attacks another he does not do it of his own action (as the lawyers say, "proprio motu"), but as representing the spirit of the clan, of the members of his tribe; and he only feels conscience-stricken when he has done something which injures his clan, his family, his totem, whatever that division may be.

Such are the fundamental errors it is necessary to guard against carefully when we examine into the ethics of primitive peoples. The prayer book of the Protestant Episcopal Church divides duties into duty toward God and duty toward the neighbor. As to the psychology of the primitive man, how much of that is actuated through duty toward God and duty toward neighbor? In the savage's sense of his duty toward God he may easily, without any fear of contradiction, be placed in the front rank as a truly religious man. I know of no sect of later religions, no branch of conventual or monastic life, which at all surpasses the ordinary roving red Indian in his devotion to God.

Captain Clark, of the United States army, one of the first authorities on this subject, says in one of his recent works that "the Indian is literally a man who prays always; he never fires a shot at the red deer that he does not offer up a prayer to his guardian spirit that the shot may hit; he never casts a grain of corn into the ground hoping that it will fructify and bring a harvest, that he does not go through a series of religious rites in order that the gods may see and prosper it and bring him the wished-for return." All his life is governed by his duty to God. Say you it is selfish—for common and material aims? Look about: What are the churches for? What are their aims? Let us not draw invidious comparisons but accept the fact, rather, that the man who is thoroughly imbued with the feeling that the unseen powers of the world are guiding and governing every action of his life, and who, in turn, is constantly appealing to them for aid, information, and succor, is a truly religious man. All who have lived intimately among untutored savages, not yet imbued with foreign ideas, are of one mind, that they are, throughout all their movements, governed to such an extent that they are the slaves of their religious sentiments.

Among those institutions of savage life which are practically universal over the world it is very obvious there are three upon which all primitive life is based, wherever we find it. One is the primitive social group. We call that, among the red Indians of America, the "totem;" among the Australian blacks, the "kobong." It is an equivalent to what the ethnologist calls the "gens;" or what we English call the "clan." Whatever it is, it is the primitive social group. It is not always based upon blood kinship, although theoretically it usually is. Most likely, as my distinguished friend Miss Alice Fletcher has urgently argued, the totem among American Indians is absolutely and strictly religious—not consanguine—based upon the founders of the totem having received similar inspirations from God in the sense of seeing identical visions. Those who dream alike form themselves into a society, and in that society grows up the totemic feeling. Wherever we find it—and we do find it among the blacks of Africa and Australia, throughout the Polynesian groups and among all the red Indians—it is characterized by this same deeply religious feeling; it governs the life of the individual. To it he owes his greatest duties, for it he will sacrifice all else. He is brought up—born we may say—into the very idea that the highest of all his duties is to the religious element expressed in the totemic bond.

Another institution, almost everywhere found, is that of the taboo—the prohibition—that which calls something sacred, which reserves something from the mass. The word "taboo" is Polynesian; but the idea of having something sacred—something belonging to God—to the divinity—is found everywhere. It may be the medicine taboo of the medicine man of the Ojibway Indians; or it may be the sacred grove such as used to shade the Temple of Delphi in Greece. Whatever it is, it is separated from secular objects and belongs to God; and woe to him who violates the sacredness of the taboo.

Third, are the initiation ceremonies (of both sexes) which are practically universal throughout the world. In Australia they are known as the bora, or burbung; and there they are carried out as the one religious service, or rite, which governs their whole lives, in whose performance the young men and women of the tribe willingly undergo such dreadful tortures as nothing in the whole list of Christian abnegation can equal. St. Simeon on his pillar was a trifle compared to what these will undergo, not single individuals, but all members of the tribe. Mutilation of the most dreadful character is willingly accepted. All this is done from a purely religious idea—from a sense of duty toward God—the sense of their religious duty overcoming all other feelings, subjecting to it all passions, sensations, and emotions. This is the power of religion in primitive life.

I might also speak of the vows they undertake at that time. So common is this among savage nations that probably not one is exempt. People lay upon themselves stringent vows which mean self-denial of that which they would most willingly do, were it not that the sense of duty prevents the doing it. There are those who, for instance, will deny themselves food of a particular kind—the kind that they most like—deny it absolutely, and will rather starve to death (and have been known to starve) rather than eat the forbidden dish. We know the prohibition which from early times was laid upon certain animals. Those animals are supposed to have been the totemic animals of the clan, from which the clan was named; and it is from that idea—that we should not taste, in any way, by killing or eating, the animal after which the clan was named—that certain prohibitions against uncleanliness have arisen—as Mohammedans and the Jews today will not eat pork, and as a great many other nations refrain from this or that article of food.

In a certain Alaskan tribe, any young man or woman who wishes to show that he or she is really a good member of their church will strip his or her back and allow all the members of the tribe, with long, sharp switches, to switch them to the extent that they desire; and this must be borne without murmuring, though their backs are flayed and the blood is streaming to their feet. This is a trifle compared to what others are willing to undergo. Those ordeals are common to almost all savage tribes and are for the one purpose of proving that they consider the sense of duty to God above any feeling—any sense—of weakness for themselves.

Are these low tests, showing no sense of duty, no desire of improvement? I call attention to the fact that the religion of savage people, by inculcating such doctrines as I have mentioned, develops some of the finest principles in human nature. It is a very good thing to have perfect self-control—to be willing to deny ourselves and do it bravely and without flinching, and permanently. The habit of obedience is a very excellent trait to be inculcated; and obedience is the very essence of the sense of duty.

They look upon their divinities as protectors—as beneficent and kindly disposed. Each Indian regards his guardian spirit as a kindly being, one who is constantly thinking of the welfare of him over whom he is placed and whom he guards; and, therefore, he attains, in his own mind, the ideal of a being constantly thinking of another being—aiming for the welfare of that other being—developing, in this way, the altruistic sense to its highest possible condition. That is shown in the ideals which they themselves form; in their legends, and in the description of their gods; because we discover, among these savage tribes, beautiful stories—not borrowed from any European source—of the gods who came to help man in his early infancy—who brought him the corn; who taught him how to manufacture his arms; who told him where the game and the fish were hiding and in all ways aided him; who gave him laws; who founded his institutions; who preserved his tribe. In all these respects he was constantly working toward an ideal of the perfectability of nature; and he himself, at times and often, sought to warn his friend and comrade to hear the exhortations of this guardian spirit and beneficent deity; he constituted in himself a deity for another one.

It thus appears that the idea of duty to God is strong, and that it is beneficent, in the savage mind. Let me now pass to the sense of duty to his neighbor. Who is our neighbor? A question put long ago. It had been answered up to that time by most men that our neighbor is a member of our family, in the first place, and next, he is locally somewhat near us, and is a member of the same clan, tribe, or nation. We feel constantly that our duty diminishes just as he is removed from us, our first duty being to those who live in our own household. If we do our duty to them, we think we are doing enough—in fact, that it is hardly worth while to let it stray next door. We rather like the text that "charity begins at home." We should not object to it if it said "and ends there." The savage does consider that it ends there; that his duty is distinctly toward his own tribe, gens, or clan, and not beyond that; and he knows very well why; because the other clan, the other gens, the other family, are trying to steal his house, his lands, and his possessions and everything else, to enslave him and perhaps to kill and eat him. Therefore, he has no sense at all of duty toward them. His duty is toward his own people only; and it is to treat his neighbor as his neighbor would treat him, if he had a chance.

Therefore, we must consider the sense of "duty to our neighbor" in the savage as confined, distinctly, to intramural residents. In this sense we may speak about his tendency to violate property rights. Complaint is often made that the savage is a natural robber—a thief. That is true. He does not rob, however, from members of his own clan, or gens. He will, as a general thing, rob from his neighbor—the other clan, the other gens, the other man. Possibly if we recall the history of America we may discover that the savage is not alone in that peculiarity.

There is another reason why we should say something in favor of him. The typical savage has no property: he does not and cannot own any. The idea of personal property does not belong to the savage: everything is owned in common in savage life: the gens—the clan—own everything. There was an Australian settler who thought that he had a method of getting ahead of the black fellows by bribing one of them to do something injurious to the fellow's clan; so he gave him some powder and trinkets; but he could not make the black understand that these were for himself, as against the rest of his clan. The savage had never been accustomed to own anything; therefore, he shared the articles with the other members of the clan and the settler failed in his attempts at bribery. Another Australian settler was indignant that they stole his sheep; he managed to seize some of the black fellows who had done so and brought them before a court of justice, such as they have on the frontiers of Australia (generally His Honor Judge Lynch presides); but a black fellow who knew enough English to make his defense said that he had not stolen the sheep—he had simply taken the sheep in place of the kangaroos which the Australian settler had shot; that the tribe generally lived upon kangaroos, but that the settlers had shot them all, so they had nothing left to live on. They did not see why they should not take the settlers' sheep, just as the settlers took the kangaroos. His Honor considered that a tolerably good plea and let him off.

Again, the idea of the appropriation of another person's property (even of a personal character), without due return for it, has gone far up into civilization. The rule of Sparta was that theft, in itself, was honorable, but to be discovered in theft was most dishonorable; and the Spartan boy in story allowed the stolen fox to gnaw out his vitals rather than disclose the fact that he had stolen. Possibly we might bring instances from nearer home where the embezzling politician is considered a very fine man and worthy of our votes, so long as it is not discovered and proved against him; and I am afraid, even in the latter case, that he would not be wholly without supporters. So the whole idea of property—the violation of property rights by the savage—is not to be considered ethically from the point of view from which we regard or pretend to regard it.

Considering his disrespect and disregard for human life—his readiness to destroy life—it has been truly said about many tribes of savages that not alone are they cruel, inhuman, and murderous toward other tribes around them, but among themselves they murder their own infants, and kill their aged when they become a burden to the tribe. It is perfectly true that they do, and in a great many instances; but here again we must look carefully to the condition of savage life. Mr. Howitt, the son of William and Mary Howitt, was a settler in Australia. He had been brought up with that delicate literary sense, and also that fine appreciation of human sentiment, which characterized the works of both his parents; and he has written upon the condition of Australian savage life in the most sympathetic manner of anyone whom I have read. He went among them; studied their life; tried to discover what prompted them to these extraordinary actions which seemed to us so brutal and inhuman; and his conclusion is interesting, because it is fair. He decides that all those actions are prompted by a sense of self-preservation—preservation, that is, not of the individual, but of the clan, or gens. He tells us that it is no uncommon thing for a mother among the Australian blacks to destroy her infants; but when she does preserve one, she loves it with a fanaticism of maternal love that Mr. Howitt says is scarcely to be equaled in civilized lands; and when that one dies, her grief exceeds all bounds. She mutilates herself and scarifies her flesh with sharp stones, showing every sign of profound and bitter grief. It is the one that she has chosen to love and rear, and that has been taken from her; and she is sorrowful and knows no consolation. So even in that low stage of society, in the midst of the violation of everything which we think sacred and holy, there is a basis—the strong sense of maternal love—truly ethical.

Then again we are constantly saying of the wild savages that they for generation after generation seek to satisfy the thirst for vengeance—they never forgive an injury. It is true; but that injury, in savage life, is scarcely ever personal. It is still the idea of the preservation of the gens. Among the Australian savages (to whom I allude more particularly, because among the lowest of human kind) the law of the gens is, if a man is killed by the whites, or by a neighboring tribe, that his blood must be washed out by the blood and the death of some one of the enemy. The duty of that falls upon the next of kin. If for instance a man is killed, a brother of the deceased must go forth and destroy some person of the enemy. If he does not, he is looked upon with the utmost contempt by the crowd. If he is a married man, his wife leaves him; if a single man, not a girl in the tribe will speak to him; if he has a mother, she will tell him to leave her house and not come back until he has washed away that stain from the tribal record. Therefore, he is forced to seek this revenge.

On this principle of blood revenge, which we find throughout the whole savage life, little by little, is built up the system of jurisprudence. It is found, after a while, that blood revenge constantly leads to another violation of life, so that a method is arranged by which compensation can be given; and that is the first step toward the jurisprudence which we enjoy. It is a very long while before we are taught that the punishment of the criminal is not a personal affair at all; it is, in reality, an affair that society has to do with, and not the person, and not the clan, nor the tribe; it belongs to society at large. Only then do we arrive at another plane of ethics; but the principle is ethical from the very start, because it is dependent upon and derived directly from the sense of preservation. If the tribe did not act thus, the other tribes around would know that they could kill them with impunity and not be killed in return; so it is directly based on what, I claim, is the ethnological foundation of ethics.

It is true, also, that parricide (the destruction of parents) is something not at all uncommon. When a man or a woman grows old, he or she is knocked on the head. They know it; they expect it; they want it; they grow tired of living. They ask for it to be done, frequently, though not always. Among the Fuegian Indians of Terra del Fuego, South America, the old women are generally eaten, and they don't enjoy the prospect; so when the tribe settles down for the night, the old women go off in the bushes and hide. Nevertheless, the custom of parricide and matricide is for the preservation of the tribe. The old people cannot hunt, they cannot catch fish; they can be of no particular use; they eat and, therefore, the slender stock of provisions on hand does not, in the tribal notion of economy, justify their continued existence, so they are made away with. Moreover, they do not enjoy life; and it is quite common, among many of the Alaskan tribes, and the Chutchi of Siberia, for the old people to say to the young members: "I am tired of living, it is time for me to go to my ancestors and pass away to the good men who have been before me. I prefer to be with them." We have very brilliant views of heaven; but I do not hear we have often any great longing to go to it. They have; they are willing to be sent there; and they usually are promptly dispatched.

I, myself, as a physician, have been repeatedly told that we are very much behindhand because we do not practice that which we fondly term euthanasia—give our old folks some potent drug which would send them off to another world. I believe the idea is that we do not do it for fear it will lessen the doctors' bills; but I am not going to debate our motive. Human sacrifice is common, even among tolerably cultivated savage tribes; but in a distinctly religious sense, and for the sake of religion, I presume we feel that we ought to do anything. It is, in fact, ethical—ethical in itself; when the mother, in ancient Carthage, used to throw her infant into the fire before the god Baal, she was performing a work of the very highest religious significance and devotion; and, although it was destructive, yet it could not be called unethical, but rather eminently ethical.

I shall pass now to feelings which are nearer to us—of personal friendship, of love; do they exist among savage tribes? Literature contains stories of how travelers among savage tribes were adopted by the tribe—taken in as brothers. It is usually by some strange ritual. The Aitas, of the Philippine Islands (we may know them better in the future), have a method of making you a brother which is touching and

simple. One will give you a rough stone; you take it and scratch his arm till it bleeds, and he yours; then he sucks your arm and you suck his, and after that you are brothers; and that Aita would die for you in a moment—he would not hesitate an instant to sacrifice his life to yours, and he expects you will do the same for him; in other words, friendship is then sealed, absolutely and without reserve. That is common among the American Indians also; repeated instances are known to me; I know men who have been adopted into the brotherhood of the clan, and they know perfectly well that any member of that clan would die in a moment to save their lives, if the occasion were such as needed it. My friend Frank Hamilton Cushing is a member of a sacred society and a brother, and he would not for a moment doubt that many with whom he is daily associated (or has been) in Zuni would sacrifice their lives to save him.

Many such examples are on record; and as for their loyalty to their own rulers, its surpasses belief. There is a remarkable story related by Sir George Gray in his "Polynesian Mythology." Telling of the habits of some of those Polynesian islanders, he speaks of a case where a number of them were with the chieftain out in his boat near one of the islands. Through some mischance the fragile boat upset and the dozen or fifteen occupants were thrown into the water. All of them joined hands and placed their chieftain in the middle of the circle. The water was filled with sharks, and they knew it; they had to swim a mile or two miles to get to land; and as they swam in that way, every now and then a shark (one of the great man-eaters of the southern seas) would seize one of them and carry him away, staining the water with the blood of the victim; but those next him would simply join hands, fill the missing place, and, thus renewing the circle, swim on, protecting, in that way, their chieftain, until they reached the land, only four or five out of the fifteen surviving; but it was personal loyalty—devotion—true friendship.

We have a foolish notion that if a person goes naked, he must be immodest. That is a great mistake. Every one who has traveled among savage tribes reports that their modesty is just as noticeable as among ourselves. Mr. Furness, who recently went through Borneo, stated, in an address which I heard him deliver, it was a common thing there for people to go wholly nude; but he said he had not witnessed, during his journey through Borneo, any woman commit a single consciously immodest act. That was high tribute; and that is a tribute which almost all travelers pay to savage tribes everywhere. They are capable of feeling deep and fine emotion, one toward the other, quite as deep as ourselves.

Father Sahagun, a Spanish monk of the XVI. century (who would not incline to overlook any weakness in the American Indians), says: "The Aztecs were a good people, attached to virtue, simple and truthful in social intercourse; they shunned lies; they were industrious in labor; and they were pious toward their gods." That, from a Spanish monk of the XVI. century, means a great deal. Father Antonio Motho was in the Philippines about 150 years ago, and went up among the little black people in the interior, in order to try to convert them. His impression is written in the true Spanish style, full of learned allusions, but pleasant to read. "I ingenuously confess," says the good father, "that their barbarous condition and barrenness of intelligence, when I came to know them well, instead of causing me pain, brought to my mind those golden ages portrayed by Ovid in his 'Metamorphoses;' by Cicero in his 'Erraticus;' and by Seneca in his 'Epistolæ;' and I also observed among them the noble virtue expressed in a sentence of Epicurus, which teaches us 'how easy it is to satisfy all the real wants of human life.'"

In support of my contention that it was through the ethical principle as representing the idea of persistence—of survival—I quote from the last gospel which has been preached (that of Darwin) by Darwin himself, who says: "Thus a tribe—including many members who might possess, in a high degree, the spirit of patriotism, fidelity, obedience, courage, and sympathy, and were always ready to aid one another and to sacrifice themselves for the common good—would be victorious over most other tribes; and this would be natural selection."

THE HAND AS AN INDICATOR OF DISEASE.

THE study of the physiognomy and of the hand is curiously interesting. It is now generally admitted that a person's character can be gaged with a very considerable degree of accuracy by a visual analysis of the features, and the same remark applies, with less force perhaps, to a study of the hand. The professors of palmistry indeed claim that they are able by a careful perusal of the lines of the hand not only to tell of the past actions of an individual, but even to peer into and raise the veil from the mysterious future and to predict with certainty as to the coming events in his or her life—when death or misfortune may be expected to occur, and whether marriage or celibacy is to be the lot of the seeker after forbidden knowledge. However, it must be confessed that the prognostications of these would-be prophets should be regarded with the same skepticism as was accorded to the prophecies of the Delphine oracle in days far back by the less superstitious members of the community, and we think that any person who is sufficiently misguided to pay good money, in the hope of thus learning his fate, is deserving of no sympathy. But the study of the face and hand for indications of disease is manifestly a great aid to a correct diagnosis.

The fact that in certain diseases the expression of the face and the appearance of the hands are fairly reliable indices of the nature and progress of the disease, is too well known to require further emphasis. For instance, a skilled physician can in the majority of cases decide if a patient is a sufferer from Bright's disease by the expression of his countenance, and can also by the color, contour, and texture of the hand, by the shape and tint of the fingers and nails, diagnose more than one complaint. For very many years clubbing of the finger ends has been held to be one of the most important signs of consumption, and the condition also appears in several other diseases. Recently Dr. Edward Blake, of London, has written a work on the study of the hand for indications of local and general disease, in which many instructive and peculiar points in connection with the subject are well brought out.

In the introduction to the book, Dr. Blake makes mention of the fact that on those rare occasions when the aid of the European physician is sought for a female member of any Mohammedan family of distinction, the only part of the patient which the doctor is permitted to see is the hand, which is thrust for that purpose through a small opening in a curtain. The object of Dr. Blake's paper, then, is to answer to the best of his ability the question as to whether it is possible that a fairly respectable diagnosis might be based upon a sight of the hand alone. In the first place it is shown that the hand is often dry in cancer and in paralytic dementia. If the hand is dry and claw-like the possibility of diabetes enters the mind; if hot, dry, and emaciated, the hectic of advanced tuberculosis is suggested. When one hand is persistently hot and the other cold, the case may be one of subclavian aneurism, but it is much more likely to be gout or else lead poisoning.

If the palm is not only hot but also clammy, the causes may be excitement, recent exertion, or hyperidrosis. A cold and dry hand may mean starvation, anæmia, or one of the innumerable forms of vasomotor ataxia. The hand is cold, harsh, and swollen in myxœdema. If cold, clammy, and tremulous, then hysteria, dyspepsia, certain depressing emotions of the mind, and the action of some nerve poisons, as alcohol, tea, and tobacco, present themselves to us. With regard to the nails the author points out that paludal fever causes in them a typical change of tint; that the nails are pale in hectic and in anasarca, gray in serious internal disease, yellow in jaundice, white in convalescence, chalky in some forms of paralysis, acutely livid in ague, and chronically purple in cyanosis. With the assertion that brittle nails accompany diabetes mellitus, Dr. Blake does not entirely agree, but says that as a matter of fact the subjects of glycosuria are prone to neuritis; and any form of peripheral neuritis, from gout to beri-beri, may be followed by fragility of the nails.

Attention has already been drawn to the long-held belief that clubbing of the finger ends is an important sign of consumption. Patrick Manson has seen it as a sequel to the evacuation of hepatic abscess by way of the respiratory passages. It has been described as a result of congenital heart disease. It is seen after nerve injury, pneumonia, and spinal caries. And the paper written by Dr. Vivian Poore on "Nervous Affections of the Hand" is quoted by Dr. Blake as noticing the fact that clubbing is absent in patients whose legs are swollen with tortuous veins; nor is it always present in bronchiectasis with emphysema, where there is considerable venous stasis; to which the writer adds that clubbing forms no part of the phenomena of Raynaud's disease, and that all the cases of Marie's disease that have been recorded up to the present time have occurred in men. The question of eruptions and invasions of the skin is entered into at some length, and instructive and somewhat curious information is given with regard to the diagnostic value of a study of the form of the hand in many diseases. In fact, it would certainly appear to be more than likely that the study of the hand is deserving of closer attention than is usually bestowed on the subject by medical men in general practice.—Medical Record.

OVERPRESSURE IN THE SCHOOLS.

To the Editor of the SCIENTIFIC AMERICAN:

I observed in your issue of November 26 the following remark, referring to a statement attributed to President Schurman, to the effect that the age of entering students at Cornell University had been continuously falling for three years, and that the high schools are increasing in efficiency:

"It would be interesting and valuable to know, also, the relative physical condition of these youths, compared with their predecessors."

Through the kindness of Dr. Edward Hitchcock, Jr., professor of physical culture, I am able to give you some information on that subject. Meantime, it is to be noted that the ages for three years, as given for the freshman class, average nineteen years and eleven months, nineteen years and eight months, and nineteen years and seven months; apparently indicating an approximation to a limit at nineteen years six months, or thereabouts, for entrance into college—which would have been thought, a generation ago, about three years too high, and by our grandparents a good age for graduation. On comparing the work of our high schools of to-day with that of the colleges of fifty years ago or more, it will, I think, be discovered that the best of them are actually graduating their pupils with practically as extensive acquirements as did the colleges at that earlier time. When the variety and extent of the courses introduced in later years are considered, it may be that we shall conclude that more is accomplished now than then.

All grades of schools are raised in the scale, and the high schools are preparing pupils for colleges which, in turn, are doing what was once denominated post-graduate or university work; and the so-called universities, where entitled to that designation at all, are offering to graduate classes the highest work in research as well as advanced and scholarly study of the original authorities. Our technical and professional schools, also, are taking an enormously higher place than formerly, and, in their most advanced representatives, demand so high a degree of preparation that, in engineering, for example, the graduates of the older sort of college, and, in fact, of the modern academic college, as a rule, cannot, except by special preparation, enter them in advanced standing. They also now incorporate large amounts of the higher work of the laboratories of applied science, and of the practice of engineering investigation and original research into their advanced courses; giving their graduates such tactical familiarity with the technical practice into which he is to be inducted that he usually adapts himself to his new environment, once in the profession, with wonderful promptness and extraordinary efficiency; thus saving for himself and for his employers a large proportion of the time and costs of the always needed initiatory stage of apprenticeship. His four years in the professional school is really a splendidly effective period of apprenticeship. It is business and education combined in the most effective possible manner.

Studying the records of measurement of our students (men) for the years 1884-1898 inclusive, at entrance, and of whom the normal weight is, in pounds, 135·2, only in the years 1888 and 1898 are the records below standard—134·8 and 133·8, and then only slightly. The height should be 1,722 millimeters, using metric measures as they happen to be recorded in this case; they were below the normal through the earlier years, usually, while in 1897 they were one-sixth of an inch below normal and in 1898 one quarter of an inch above. During the years 1889-1898, inclusive, the weights are from one to ten pounds, as an average, above the normal for the age; during 1897 one pound above, in 1898 something over a pound below. In the earlier years, the chest measurements were one or two per cent. above the normal, in the later years about as much below. The differences are not very marked or very regular and it remains uncertain what is the direction in which, ultimately, the change will take effect. There is certainly no evidence that a falling off in physical condition or build is in progress. Such changes as appear are, I think, due rather to a change in the total numbers and in the social position of entering men. The impression is general that the frame is assuming greater altitude, the form becoming more slender in youth, and that the race as thus represented is a taller one than formerly; but whether the apparent spareness may not be found to disappear with maturity remains to be seen. There is apparently no evidence that conditions here differ from those in the world of business, or that pressure in the schools is affecting our physique in greater degree than formerly. We find no very observable departure from the normal proportions as laid down by the authorities for the well built man as yet.

An interesting and unique experiment was made a few years ago, in Sibley College, which gives us some light on this matter. Owing to overcrowding, the authorities were compelled to take radical measures to reduce numbers, and advantage was taken of the circumstance to try the effect of advancing the entrance requirements by a year of work in the higher mathematics. The numbers of men entering the freshman class were reduced by this drastic action by about forty per cent.; but we find that the average age of entrance remained very nearly as before, and the men, so far as could be seen, in spite of their evident extra work in preparation, were physically equal to the average of the earlier years. There is no question that our schools are being driven up to very high pressure; but we have no evidence that any marked change in physical condition has come of those advances which have resulted in reducing the ages of our entering students in the face of increasing entrance requirements and of heavier demands in the preparatory schools.

Possibly time is required to develop such effects.

R. H. THURSTON,
Director Sibley College.

Cornell University, Ithaca, N. Y.

OVERPRESSURE IN SCHOOLS.—STATISTICS, 1884-1898.

Date. Datum.	1898. Normal.	1897. Actual.	1897. Actual.	1896. Actual.	1895. Actual.	1894. Actual.	1884. Actual.
Weight	135·2 lb.	133·8 lb.	136·0 lb.	142·7 lb.	145·3 lb.	142·4 lb.	133·4 lb.
Height	5 ft. 8·8 in.	5 ft. 9·2 in.	5 ft. 8·8 in.	.....	.....	.....	5 ft. 8·4 in.
Chest	32·08 "	34·6 "	34·8 "	.....	.....	.....	35·56 "
" Expanded	36·96 "	36·87 "	.....	.....	.....	.....	37·16 "
Thigh	20·06 "	20·36 "	20·63 "	.....	.....	.....	20·28 "
Calf	14·16 "	13·63 "	13·76 "	.....	.....	.....	13·86 "
Biceps	11·76 "	11·66 "	13·85 "	.....	.....	.....	11·64 "
Forearm	10·56 "	10·59 "	.....	.....	.....	.....	10·49 "

The balance of data, where blanks appear, are not to be found at this moment, and presumably were not preserved by the officers in charge of this department in those years.

The official statistics for 1897 of the French Minister of Public Works speak of 45 steam accidents, which killed 26 people and wounded 26 seriously, i. e., so as to incapacitate them for more than 20 days. The lists comprise boilers and steam receptacles of all types. How necessary it is to keep the latter apparatus under control is shown by the circumstance that 10 accidents demanding 15 + 14 victims, killed and injured, are due to steam cylinders, etc. The next heavy item is that of water-tube boilers. There were 15 accidents, but they killed only 3 men and disabled 3; they do, therefore, comparatively less damage. Horizontal non-tubular boilers caused 6 accidents, with 6 killed and 3 wounded; horizontal tubular boilers, 8 accidents, with 1 killed and 5 wounded. Speaking in general, therefore, tubular boilers are less to be feared than other types. The lists enumerate 62 causes of all kinds for the 45 accidents, by which we have to understand that some explosions were ascribed to several coacting causes. Ten accidents are charged to overheating and deficiency of water; none of the other causes occur more than three times in the list.

A NEW WATER FILTER.

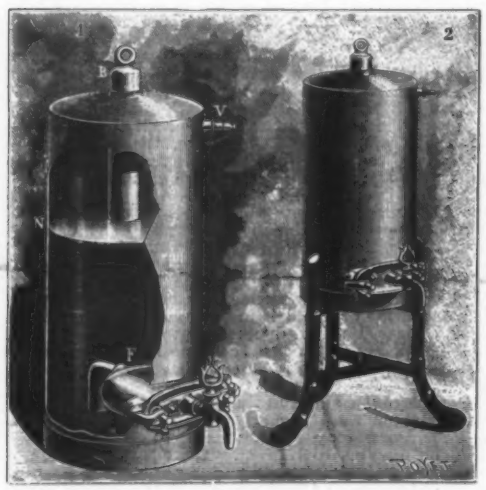
WE borrow from La Nature the following description and accompanying illustration of a new water filter devised by Messrs. Prevet & Company, of Paris.

It is now agreed by all hygienists that a large supply of water should not be accumulated where the liquid may become contaminated. Any water, even that derived from springs, may, upon remaining in a reservoir in which other water has stood, become polluted. In order to illustrate this, it will suffice to recall the fact that during last summer the water service of Paris, in order to satisfy the demands of consumers, had to mix in the reservoirs water from the Vanne, the Avre, the Dhuys, the Marne and the Seine. Now it was found that the water of the Vanne, which contained scarcely 700 microbes per cubic centimeter upon reaching Paris, contained 212,000 when it emptied at the Wallace fountains after traversing all the reservoirs and all the mains.

The filtration of water before it is used therefore becomes necessary in every dwelling. Messrs. Prevet & Grandjean have thought that it would be well in certain cases if people could have at their disposal a certain quantity of pure water, and to this effect they have devised the small fountain illustrated herewith. These apparatus contain 5, 15 or 25 quarts of water under pressure, and are capable of furnishing from one to three quarts per minute of completely sterilized water, which is filtered upon making its exit from the apparatus. The utility of such fountains in localities where there is no distribution of water may readily be seen.

No. 1 of the figure shows the interior of the apparatus. At *B* there is a screw plug which closes the orifice through which the water is introduced. A tube that descends from this orifice to within about a third of the height from the bottom limits the level, *N*, of the quantity of water introduced. Around this tube there is a space forming an air chamber, wherein a pressure is effected through a small air pump adjusted upon the valve, *V*. When the cock at the bottom is opened, the water is forced by the pipe through the filter, *F*, and after this makes its exit from the apparatus.

The arrangement of the filter is the same as that of the Eden apparatus made by the same house, and



A NEW PORTABLE WATER FILTER.

1. View of the interior. 2. General view of the apparatus.

which we have already described. The water passes through a series of disks of filtering paper, and finally through a lens of charcoal. This latter is compressed and does not, as in previous models, contain a chamber in the interior. The disks of paper are taken out and replaced by others in measure as they become incrusted with materials that the water holds in suspension.

An order recently issued to the train hands of the New York, New Haven and Hartford Railroad is in the interest of the passengers. By it the employes are instructed to see that each passenger has a seat. It is their business to attach sufficient cars to trains at terminal stations to seat all the passengers, and, if needed, they must attach other cars at stations along the route. They are instructed also that each seat is intended for two, and that no one passenger shall occupy a whole seat, either by himself or his baggage, if other passengers are standing. In their treatment of the "railroad hog" the employes are told to be firm but diplomatic. Of course, this is only an affirmation of an old rule, but the specific way in which it has been reissued gives assurance of an intention to enforce it. Hope may be entertained also that other good will accompany its enforcement. The train hands, impressed by the consideration shown by the management to its patrons, may see a chance of preferment for themselves through attention to other details contributing to the comfort of the traveler. Then more attention may be given to the temperature of the air in the car, and to ventilation, the car doors will not stand open in a gale of cold wind while the train stops at a station, the passenger seated in front of you will not shower you with cinders from his open window, names of stations will be announced distinctly, and many other minor discomforts will be remedied.

Softening Bones.—J. J. Andeer finds that an aqueous solution of phloroglucin acts as a powerful decalcifying agent on the bones of animals, but is without action on the most delicate organic tissue. If treatment with hydrochloric acid be employed as well, the residual "ossein" will be without a trace of either calcium phosphate or carbonate.—Comptes Rendus, cxxvi., 1295.

VALUABLE BOOKS.

MAGIC

Stage Illusions and Scientific Diversions, Including Trick Photography.

By ALBERT A. HOPKINS,

Editor of the "Scientific American Cyclopedia of Receipts, Notes and Queries," etc.

This unique work appeals to the professional and the amateur alike and will prove a welcome addition to any library. The illusions are illustrated by the highest class of engravings.

Great attention is paid to the exposés of large and important illusions; these have been in many cases furnished by the prestidigitateurs themselves. Some of the most important tricks of Robert Houdin, Bautier de Kolta, Heller, and Herrmann are explained. Conjuring is not neglected, a selection of some of the best known of these tricks having been made. Fire-eaters, sword-swallowers, ventriloquists, shadowgraphists, all come in for a share of attention, while the chapter on "Mental Magic" describes simple means of performing second-sight.

Such entertainments as cycloramas, fireworks, etc., are also treated, and all well illustrated with original engravings. Automata and curious toys are then described.

This work is acknowledged by the **Profession** to be

THE STANDARD WORK ON MAGIC.

The section devoted to Photographic Diversions is very complete, giving the method of producing astonishing trick photographs. The method of taking and projecting moving photographs is described in detail—the vitascope, the cinematograph, the mutoscope, and the mutograph being fully described and illustrated. This work cannot fail to be of interest to young and old, and there is hardly any one who is in any way interested in either science or magic to whom it will not appeal. It is beautifully printed and is very attractively bound in special cloth, with stamp in colored inks.

SECOND EDITION NOW READY.

568 Pages. 430 Illustrations.
Price, by mail to any part of the world, $2.50.
An Illustrated Circular sent on Application.

1898 EDITION.

EXPERIMENTAL SCIENCE.

By GEO. M. HOPKINS.

Twentieth Edition, Revised and Enlarged. 914 Pages. 820 Illustrations. Elegantly bound in Cloth. Price, by mail, postpaid, $4.00; Half Morocco, $5.00.

This is a book full of interest and value for teachers, students and others who desire to impart or obtain a practical knowledge of Physics.

This splendid work gives young and old something worthy of thought. It has influenced thousands of men in the choice of a career. It will give anyone, young or old, information that will enable him to comprehend the great improvements of the day. It furnishes suggestions for hours of instructive recreation.

What the Press says of "Experimental Science."

"Mr. Hopkins has rendered a valuable service to experimental physics."—*Evening Post.*

"The book is one of very practical character, and no one of a scientific turn of mind could fail to find in its pages a fund of valuable information."—*Electric Age.*

"The work bears the stamp of a writer who writes nothing but with certainty of action and result, and of a teacher who imparts scientific information in an attractive and fascinating manner."—*American Engineer.*

"It should be found in every library."—*English Mechanic.*

"The book would be a most judicious holiday gift."—*Engineering and Mining Journal.*

Mr. Thomas A. Edison says: "The practical character of the physical apparatus, the clearness of the descriptive matter, and its entire freedom from mathematics, give the work a value in my mind superior to any other work on elementary physics of which I am aware."

Prof. D. W. Hering, University of the City of New York, says: "I know of no work that is at the same time so popular in style and so scientific in character."

Prof. W. J. Rolfe, of Cambridgeport, Mass., writes: "The book is by far the best thing of the kind I have seen, and I can commend it most cordially and emphatically."

Hundreds of cordial recommendations from eminent Professors and Scientific men.

Send for Illustrated Circular and Table of Contents.

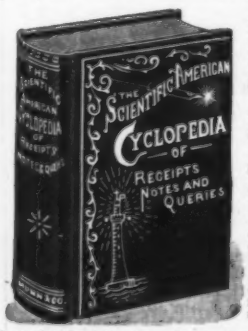
THE SCIENTIFIC AMERICAN

CYCLOPEDIA of RECEIPTS, NOTES and QUERIES

EDITED BY ALBERT A. HOPKINS.

12,500 Receipts, 708 Pages.

Price, $5 in cloth; $6 in sheep; $6.50 in half morocco; Postpaid



This splendid work contains a careful compilation of the most useful Receipts and Replies given in the Notes and Queries of correspondents as published in the SCIENTIFIC AMERICAN during the past fifty years; together with many valuable and important additions.

Over twelve thousand selected receipts are here collected; nearly every branch of the useful arts being represented. It is by far the most comprehensive volume of the kind ever placed before the public.

The work may be regarded as the product of the studies and practical experience of the ablest chemists and workers in all parts of the world; the information given being of the highest value, arranged and condensed in concise form, convenient for ready use.

Almost every inquiry that can be thought of, relating to formulæ used in the various manufacturing industries, will here be found answered.

Those who are in search of independent business or employment, relating to the home manufacture of salable articles, will find in it hundreds of most excellent suggestions.

A COMPLETE

ELECTRICAL LIBRARY

By Prof. T. O'CONOR SLOANE,

Comprising five books, as follows:

Arithmetic of Electricity, 138 pages	**$1.00**
Electric Toy Making, 140 pages	**1.00**
How to Become a Successful Electrician, 189 pp.	**1.00**
Standard Electrical Dictionary, 682 pages	**3.00**
Electricity Simplified, 158 pages	**1.00**

☞ The above five books by Prof. Sloane may be purchased singly at the published prices, or the set complete, put up in a neat folding box, will be furnished to Scientific American readers at the special reduced price of **Five dollars.** You save $2 by ordering the complete set. **Five volumes, 1,300 pages, and over 450 illustrations.**

☞ Send for full table of contents of each of the books.

☞ Our complete book catalogue of 116 pages, containing reference to works of a scientific and technical character, will be sent free to any address on application.

MUNN & CO., Publishers, 361 Broadway, N. Y.

THE

Scientific American Supplement.

PUBLISHED WEEKLY.

Terms of Subscription, $5 a Year.

Sent by mail, postage prepaid, to subscribers in any part of the United States or Canada. Six dollars a year, sent, prepaid, to any foreign country.

All the back numbers of THE SUPPLEMENT, from the commencement, January 1, 1876, can be had. Price, 10 cents each.

All the back volumes of THE SUPPLEMENT can likewise be supplied. Two volumes are issued yearly. Price of each volume, $2.50 stitched in paper, or $3.50 bound in stiff covers.

COMBINED RATES.—One copy of SCIENTIFIC AMERICAN and one copy of SCIENTIFIC AMERICAN SUPPLEMENT, one year, postpaid, $7.00.

A liberal discount to booksellers, news agents, and canvassers.

MUNN & CO., Publishers, 361 Broadway, New York.

TABLE OF CONTENTS.

	PAGE
I. ANTHROPOLOGY.—The Ethics of Primitive Peoples	19321
II. AUTOCARS.—Hill Climbing Motor Car Tests	19315
III. BIOGRAPHY.—Hermann Wilhelm Vogel.—1 illustration	19313
IV. BOTANY AND HORTICULTURE.—Another New Fruit.—2 illustrations	19323
V. CERAMICS.—Brick and Clay in the Bible.—By GEORGE GILLEN, Jr.	19319
VI. ECONOMICS.—Our Trade with China	19321
Our Trade with Japan	19321
Scotch Opinion of United States Goods	19322
VII. EDUCATION.—Overpressure in the Schools	19325
VIII. ELECTRICITY.—Electric Towing upon Navigable Waterways.—4 illustrations	19320
IX. GEOLOGY.—The Geology and Archæology of the California Gold Fields	19313
X. ILLUMINATION.—Automatic Lighter for Gas Burners.—1 illustration	19315
XI. MATHEMATICS.—The Chapman-Hunter Pitchometer.—1 illustration	19314
XII. MECHANICAL ENGINEERING.—Portable Petroleum Engine.—1 illustration	19315
XIII. MEDICINE AND HYGIENE.—The Hand as an Indicator of Disease	19325
XIV. METALLURGY.—Iron Production During Forty Years	19318
XV. METEOROLOGY.—Mirage	19317
XVI. MISCELLANEOUS.—A German who Walks on Water.—1 illustration	19322
How Prisoners Lived in the Bastille	19322
Apothecaries' Signs in the Olden Times	19312
Engineering Notes	19316
Miscellaneous Notes	19316
Selected Formulæ	19316
XVII. NAVAL ENGINEERING.—A Representative Battleship and Coast Defense Vessel of the French Navy.—2 illustrations	19311
XVIII. RAILWAYS.—The Railways of the French Soudan.—4 illustrations	19318
XIX. STEAM ENGINEERING.—Mumford's Water-Tube Boiler.—1 illustration	19314
XX. TECHNOLOGY.—A New Water Filter.—1 illustration	19316

SPECIAL NAVAL SUPPLEMENT No. 1165

contains a historical review of the modern United States navy, the classification of the various forms of war vessels and nearly one hundred illustrations, including details of construction of such vessels not found in any other publication. A map of Cuba printed in five colors accompanies it. Price, 25 cents. Single copies sent by mail in United States, Canada and Mexico. Foreign countries, 8 cents extra.

MUNN & CO., 361 Broadway, New York.

THE SCIENTIFIC AMERICAN

Army and Coast Defence Supplement

It treats of guns and gun carriages for Army and Navy use and Coast Defence, including disappearing gun carriages, rapid fire guns, machine guns, mortars, etc., with special reference to their construction and operation. The subject of projectiles, powders, gun cotton, etc., is also fully treated; range finders, torpedoes, submarine mines and armor are all fully described and illustrated. There is also a section devoted to the small arms of the Army and Navy, together with an account of the organization of the Army, with fine engravings of prominent Generals. Never before have these subjects been treated in such a popular way. The illustrations number over 100 and include a magnificent double page Supplement of our largest battleship, the "Iowa." The whole is enclosed in a handsome cover, showing a large coast defence gun in action.

Price by mail, 25 cents; to foreign countries, 35 cents.

MUNN & CO., Publishers, 361 Broadway, New York.

BUILDING EDITION

OF THE

SCIENTIFIC AMERICAN.

Those who contemplate building should not fail to subscribe.

ONLY $2.50 A YEAR.

Semi-annual bound volumes $2.00 each, yearly bound volumes $3.50 each, prepaid by mail.

Each number contains elevations and plans of a variety of country houses; also a handsome

COLORED PLATE.

SINGLE COPIES, - - - - 25 CENTS EACH.

MUNN & CO., 361 Broadway, New York.

PATENTS!

MESSRS. MUNN & CO., in connection with the publication of the SCIENTIFIC AMERICAN, continue to examine improvements, and to act as Solicitors of Patents for Inventors.

In this line of business they have had over *fifty years' experience*, and now have *unequaled facilities* for the preparation of Patent Drawings, Specifications, and the prosecution of Applications for Patents in the United States, Canada, and Foreign Countries. Messrs. Munn & Co. also attend to the preparation of Caveats, Copyrights for Books, Trade Marks, Reissues, Assignments, and Reports on Infringements of Patents. All business intrusted to them is done with special care and promptness, on very reasonable terms.

A pamphlet sent *free of charge*, on application containing full information about Patents and how to procure them; directions concerning Trade Marks, Copyrights, Designs, Patents, Appeals, Reissues, Infringements, Assignments, Rejected Cases, Hints on the Sale of Patents, etc.

We also send, *free of charge*, a Synopsis of Foreign Patent Laws showing the cost and method of securing patents in all the principal countries of the world.

MUNN & CO., Solicitors of Patents,
361 Broadway, New York

BRANCH OFFICES.—No. 625 F Street, Washington, D. C.